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THE ELECTRIC CLUB

Most Successfully Inaugurates Its Lecture Season.

THE LECTURER'S "CASUAL IDEAS" PROVE TO BE A MINE OF VALUABLE SUGGESTIONS.

The attractive, well-lighted parlors of the Electric Club were filled with members and invited friends Thursday evening, October 17th. It was the occasion of an address by Dr. Leonard Waldo, of Bridgeport, Conn., electrical engineer of the Aluminum Bronz Company, formerly of the Yale Observatory. The meeting was the first of the lecture season, and the large attendance and the interest expressed were conclusive proofs of the importance and nature of these monthly gatherings of electrical men. Among those present were A. R. Foote, special agent of the Census Bureau for the electrical industry; F. S. Terry, Chicago; H. J. Conant, Boston; A. J. De Camp, Geo. F. Porter, Philadelphia; M. Roman, Paris; E. G. Acheson, Pittsburgh; E. S. Hayden, H. L. Bancroft, H. D. Stanley, Dr. L. Waldo, Bridgeport; E. B. Baker, New Haven; W. T. Beidler, Baltimore; D. L. Hungerford, Waterbury; H. Ward Leonard, C. O. Baker, Jr., Geo. B. Coggeshall, P. H. Alexander, C. H. Barney, J. H. Balston, E. E. Bartlett, Channing Baxter, H. E. Baxter, T. P. Conant, Jarvis B. Edson, J. Furgeson, E. T. Gilliland, A. V. Garratt, H. D. Hall, S. Insull, W. D. Ludlow, Geo. T. Manson, F. C. Mason, E. F. Peck, C. W. Price, H. A. Reed, T. L. Scovill, C. E. Stump, C. E. Shainwald, W. D. Spear, J. C. Tomlinson, F. Vonder Luhe, Dr. S. S. Wheeler, G. C. Wilde, G. Worthington, F. H. Wall, G. W. Walker, W. S. Perry, S. Marsh Young.

A number of gentlemen participated in the Club dinner prior to the meeting. At 8.30 President Gilliland called the assembly to order, and introduced Dr. Leonard Waldo, who spoke as follows:

"SOME CASUAL IDEAS CONCERNING THE REQUIREMENTS, POSSIBILITIES AND RISKS OF THE ELECTRIC CLUB."

In other days, when the spirit of adventure was more fully upon me, I have sometimes heard a disconsolate man-of-wars-man, in the face of gales which were strong and topsails to be lowered, sing out,

"There is a sweet little cherub sitting up aloft,
Who always looks out for poor Jack."

The refrain came back to me when our cherubic secretary casting his eye horizonward and spied a poor Jack who was unluckily constrained to appear before you and discuss a topic concerning which he is perfectly confident any other member of the Club knows more than he. Most of us are somewhat familiar with the requirements, at least the financial ones, of the Club; perhaps we have never thought of any other possibilities than those which occurred to the dog when he had his day, and as to there being any risks, it is supposed that our insulation and our insurance is such that we have reduced risks to a minimum, besides which a number of our brightest co-workers have shown clearly to the public at large that there can be no, at least fatal, risks connected with electrical machines, social or otherwise.

Our Club is a peculiar one; unlike the Electric Light Association, we are democratic, and our list of members include those who invent, and those who construct, and those who make, and those who sell, and those who describe. And then there is that additional class who lead us into the courts of the law, and too often into the temples of injustice, and who teach us how to spend the money of our stockholders in litigation. We have not many who might be called "club men." I doubt whether we have very many out of whom club men could be made. Our dinner tables, well stocked as they generally are, with the nature and art of the times partake more of the nature of the business man's lunch than they do of the leisurely discussed club man's dinner. As a club we are constantly reminded of, and are in connection with, the central idea upon which we are founded. This idea I take it to be is that among the workers in the tremendous activity of the new servant of the world's progress, there are grouped in the metropolis of the new world quite enough men of brains and money and associative proclivities to establish a meeting place for them. And without considering very much the whys and wherefores we find ourselves associated, owning property, and with the machinery and social organization of a club.

The first thing which strikes us is that the Club is a meeting ground of practical and scientific men. I dislike these terms, they are misleading, but they will suffice for the present. I do not recall any other meeting ground quite as good as this for these two classes of people. Because here we have the meeting of the three parties to the electrical progress; the capitalist, the inventor and the engineer. It is a limitation of human nature that we often incorrectly attribute to a man's scientific knowledge, his imperfections in other ways. A man's pure science may lead him to very accurate calculations, and so far his knowledge is good and useful. His want of businesslike habits, his lack of industry in unaccustomed channels of work, and the human nature which prompts him to think that his success in lines of thought must necessarily be indicative of success in lines of action may be the true causes of his want of practical success. By habit and tradition, however, the practical man assumes that the want of success is owing to his friends, being a theorist, and so between practice and theory, there has been a distrust on the one side, and the coolly dignified non-interference in the affairs of the practical life on the other.

Any one who has to do with shops and artisans knows that what are commonly called "shop methods" are the happy discoveries of generally intelligent artisans, and that they frequently anticipate by years or centuries the theoretical deductions of the purely scientific student. I have sometimes wondered in watching a skillful melter pouring heavy crucibles of molten bronzes how long it would be before the student of molecular physics would be able to compute the wave length which light should have in order to give the peculiar hue which tells the experienced practical founder just when he can pour metal so that it shall have a maximum of strength or of ductility. The calculation of the orbit of Neptune is a childish problem in comparison with the calculation which should determine the simple fact which is daily knowledge with the founder. On the other hand, the same founder would be at a dead loss if he were to try to deal with the problems of magnetic fields and electric capacities by the accumulated wisdom of his cast or any shop methods of his present resource.

In the union of pure and applied electricity therefore, there is a very exceptional opportunity to dispel much of the estrangement which has existed between the two classes of human workers; nowhere else are the results of the highest science so quickly applicable to the progress of the race. No place else is better than the arena of a social and professional club. It is an experience not likely to be forgotten when one trained as a student of pure science passes into the field of practical construction, and having lost the feeling of warm fellowship which exists between the students of pure science, he feels the withering scorn of the bench worker, or the office man who has risen from the bench, whenever he ventures his advice concerning subjects which he has not studied, save in the school room or the laboratory. The man who applies the spectroscope to the Bessemer converter must look out for himself while he is around the furnaces. For the man of ideas and theories is at best a heretic in the field of practice. The field of practice always represents the powers that be, these are always conservatives and fearful of innovation. It was maintained by the powers of the church whose conception of the physical heavens was rudely disturbed by the immortal Galileo that, though his telescopes were trustworthy so far as terrestrial objects were concerned, yet they were utterly misleading when directed towards the heavens.

One of the first requirements of our Club, I should say, is a library. If we visit the University Club, or the Union League, or the Law Club, we find therein well stocked

THE DWIGHT SLATE ENDLESS-BELT MULTIPLE-SPINDLE DRILL. (See page 2.)

libraries. If we visit our Club, which presumably is an equally good place for retirement and leisurely study, we find our larder much better stocked than our library. There are hardly any of us but who have wanted, at some time or other, to consult some of the working books; and we have wanted to use them under the freedom from restriction which the Club library gives. This is particularly true, I suspect, of the non-resident members of the Club. A patent case, a question of supplies, a desire for quiet study away from the busy life of the factory, and we naturally turn to the quiet of the Club. We have one great advantage in establishing our library; the literature is new, the books can be had and we do not require many of them. Three thousand volumes well selected with the periodicals to date would give us what we need. We have the room, and a library committee could arrange the care and custody of the books to the entire satisfaction of the Club's members. I am not sure but that the members would respond to a call for the gift of books, but in that case care must be taken to have it understood that the library committee would return books which were duplicates or which seemed unlikely to be of such permanent value to the Club that the shelf room could be afforded. I venture to leave the suggestion that we establish a good professional library at the Club's rooms in the confident belief that it will receive your serious consideration.

When the Club was first organized I remember the project of establishing a laboratory was discussed; I do not know what the opinions were at that time which prevailed against it, but I hardly think it is possible for the Club to maintain a laboratory. A book is not apt to be rendered unserviceable to one man because another man reads it; but I am very much afraid that the galvanometers used by one observer would be quite useless to the habits and individualities of another. The maintenance of a laboratory is in itself a complicated undertaking, and no one face to face with the actual conditions of maintaing a laboratory in the state of efficiency would think it possible under the auspices of Club life.

I have already pointed out that in the quiet seclusion of the Club the men of thought, and the men of capital and action, meet. It is among the possibilities of the Club that this meeting and discussion over the post prandial cigar should have its fruition in the solution of the public problems which the advent of electricity has introduced. There are mines of valuable information sunk deep in the transactions and archives of the learned societies which are unheard of by the men who alone can make such ideas effective and profitable to our civilization. Club discussion is *sui generis*. It has not the formalities or the scientific comprehensiveness of the professional and technical society, nor has it the want of knowledge characterizing the ordinary lay discussion of technical subjects. It is humanitarian as well as scientific. It is social as well as technical; and a man who thinks, sees how to think directly in the line of human needs, and the man who pays and builds sees better for what to pay and how to build.

We are a metropolitan Club. There are certain live issues agitating metropolitan life; and with these issues we have as direct a relation as had the Union League Club with the political life of the United States at the time of its formation. We know that the light of the twentieth century is to be found in electricity. We know that we are public benefactors when we turn the light of electrical day into the dark corners where crime and pauperism make property unsafe and life wretched; and yet I think there is not one of us but feels in our inner hearts that there is something wrong when we allow our angel of life and light to become an angel of death. It is a stinging rebuke to our scientific and business enterprise when this faithful lineman, or that ignorant and inoffensive child, becomes a victim to the power we are distributing. We all know the steady battle which progress is always waging. Perfection only can come after this difficulty, and that unforeseen at the commencement has been surmounted.

Each individual case of the applications of electrical power presents new difficulties and different ones from any of its precedents. The lighting of a closely populated metropolis is a very different problem from that of lighting a coal mine or a village; in the metropolis the electricity is harnessed to many needs; the exquisitely delicate telephone, the heavily belted engine, the telegraphers' key and sounder, and the electrical platers' vats, are all members of the swarm of electrical powers. They each have their rights; they each have their representatives in such a club as ours. Nowhere else can the fruitful tree of concerted action be so well planted and tended as around the genial fires of our Club.

It has happened to me in the line of professional work, to have been in charge of the most powerful dynamos the art of man was able to construct at the time of their erection; I have seen those dynamos running day and night tended by relays of or-

dinary workmen and blazing away continuously from three to six thousand amperes of current and feeding the blinding mass of electricity through groups of seven carbons, each carbon 2½ inches in diameter, in the furnaces which were melting the sands of the sea and in which firebrick melted and ran like molten metal. I have seen the connections of copper cable handled with the utmost impunity by the commonest day laborer around the works, and with no more thought or concern than he would have shown in handling a spade or crowbar. The current through the twisted cables produced about the copper so strong a magnetic field that a small bar of iron would be held by the copper cable as by a magnet. I suppose that the amount of current ordinarily proving fatal is between one tenth and one-twentieth of one ampere, and that the laborer handling such furnace conductors would be instantly killed if so much as one-fiftieth thousandth of the current left the bare conductor and passed through a vital organism. Now, is there any very good reason why conductors which are meant to deliver at arc light terminals, say 10 amperes current, should be so fraught with danger when their insulation is broken? Is it the price of copper which makes multiple wire distribution too expensive? Is it the invasion of the patent field by men who have been quick to combine old principles and common knowledge into new combinations by which vested capital was protected by the courts? Have our engineers made the mistake of forgetting the value of human life and net-worked a community with conductors having poor insulation from within outwards, and who have failed to anticipate the necessity of protection from without inwards? It is not so difficult to make the current keep its proper path by outward insulation, but it is very difficult to make the insulation stay where it is put when attacked by the chemical destroyers in the air and the physical accident of storms, cuts and blows. As to burying such conductors, about all that can be said is that they will make a very lively graveyard for some of their mild-mannered and inoffensive telephonic and telegraphic fellow corpses.

In Paris they are fond of catacombs and underground runnels and that sort of thing, but in New York the earth beneath and the waters under the earth conspire to make such burial probably impracticable. As it was said of marriage it might be a failure, but celibacy was a much greater one.

Now, if copper profitably mined at six cents and paid for by us at 11 is too expensive to establish the proper mains in New York for low tension lighting, it is right here and among our own possibilities that we can discuss and formulate the legislation necessary to give us raw material for making metropolitan electric lighting safe and economical; the low tension current of such an electrical furnace, as I have before referred to, would supply perhaps 5,000 incandescent lamps with perfect safety, but to distribute these lamps will require plenty of copper, and the ultimate economy of long distance transfers of light or power is a question of the cost of copper. Copper with us is raw material, and after our bitter experience with the copper syndicate, I can conceive of no argument which can be used with electrical people for adhering to a protective tariff on copper. There is no use in the gas people thinking that they are the people to furnish light, for lighting purposes gas is as certainly doomed as the stage coach upon the appearance of the railroad. The province of gas in the future is to supply heat and not light, and if we are temporarily exposed to the comment of an indignant public, it is because we have builded according to the light we then had and not always wisely nor well, and have been hampered too much by the ignorance of legislators, or the importunities of stockholders, and have strained the capacities of individual lighting systems by placing them in positions for which they were not on the whole adapted.

The energy and practical skill of the exploiters of any given system is dangerous to the community, unless it is accompanied by the kind of knowledge which informal discussion in such a Club as ours would give. The public once roused is a good deal of a mob, and they are apt to fall upon the just and the unjust alike; it is for us to play a strong part in moulding and enlightening such public opinion, and to see to it that our social standing and the good, honest work which we do is such as to make us a power in the community in any cause which we champion.

If our possibilities are great, our risks are great also; we do not go to the Club to work; nothing could be worse for us than the idea that we were attending a meeting of an academy of sciences in club matters; and my own observation leads me to remark that no casual observer of club nights would ever mistake a meeting of this Club for a session of an academy of science. In fact not a bad inscription for our walls to date might be,

"We may live without books, but not without cooks."

And as a committee of one, appearing at unexpected times and calling upon the culinary department for a service ranging between coffee and rolls at seven in the morning, and a full-fledged dinner at seven in the evening, I can testify to unvarying good work in this department of our Club.

We must lose nothing of the social and physical comforts of our club life, and we must guard it against the entrance of shop. We must unite good living and good thinking, and must be capable of good nonsense and be on the whole an invisible power in the community.

The discussions of a social and professional club are those of principles and general lines of practice, rather than those of details of construction. The point of view is that of the man of affairs and is over a broader horizon than that of the technical engineer. As a Club we want to come here to the best life and to the actuating principles of both theory and practice; we should take special pains to draw to ourselves the younger blood of our technical schools as well as the scholarship of our teachers of applied physics. The Cobden Club, in England, which is an ardent supporter of the new political economy, has established a custom which we might imitate to some advantage: they offer prizes for papers on definite subjects with the result of drawing to the moral support of the club a great many of the younger thinkers. Our cosmopolitan position lends a peculiar attractiveness to the young student to any prizes we might offer of this kind; and I think we might safely count upon an active interest being taken in the question of competitive papers being submitted to a committee of our Club by students in the professional schools and, I might also suggest, by young men in the actual service of electrical companies. The successful papers might be printed by the Club as having received the Club's prize. The purely social side of our Club life may show itself more than it has, I think, by a cultivation of our foreign relations. The Club is the natural place of entertainment to the foreigner, and there is no city in the Union in which club life enjoys such perfection as in New York. A very little outside experience will satisfy any member that we are regarded as representatives, and it behooves us to jealously guard our reputation for hospitality. It should be at the rooms of our Club and around our own festal board, that "the impression of America" of our foreign professional associates first find expression. It is not a bad idea to extend the social advantages of the Club to a certain number of foreign honorary members, and thus to have them feel continuously *en rapport* with us.

We should make it a point to include in our membership the strong men and the broad minded men who are in each of the classes of electrical industry which have been referred to, and I think the risks of the Club would be lessened if we were able to provide positive entertainment certain nights of the year. The Club papers might border upon the lines of comedy, or of finance, with equal benefit to the Club; and it might often happen that a programme of several numbers would prove entertaining and instructive as well: a bit of music, a sketchy poem, a novel piece of apparatus are all within the scope of Club nights. On more pretentious occasions the Club might hold conversaziones to which ladies are invited, and which by a little concurrent action could be made extremely attractive to those objects of beauty and joy in the neighborhood of which the most dangerous of sparking occurs.

And now, gentlemen, I feel that in your thoughts you are accusing me of a bit of idealization concerning our Club and its possibilities. You think that in the busy life of the members you have best personal knowledge of that there is scant time for the work necessary to the Club's growth. I can only remind you of the truism that it is the busy men who have time for hard work in any direction, and trees and ideas must be planted before they grow. Our Club already has influence and reputation. The lines I have indicated will add to the good strength of the one and to the luster and wideness of the other. We can make our Club a citadel of culture and professional progress, and we can rise ever upwards till we realize, with the golden haired little child, that "the stars are made of lightning."

At the close of the address, Dr. Waldo was asked to give his views on the question of electrical execution.

Dr. Waldo: Mr. President, I think I am one of the majority in regard to electrical execution. I think our views have all been ingeniously expressed between the lines of the various pieces of expert testimony for the edification of the public concerning the fatality of electric currents. I do not think that we ought to be put in the position of introducing a new monster for the destruction of those whom the law has plenty of opportunity for removing in other ways, and I feel that there is a good deal of justice in the plea that to execute by electricity is to give the unnecessary horror of tradition to that which is a powerful agency for good, and which, in its birth, is entitled to a fair start on its career through the civilization of the centuries to come. I think that there are abundant means for the execution of criminals which are utterly free from any ethical objections, and it has always seemed to me a burning shame that we should be called upon to help to explain the agent, the knowledge of which is for the good of mankind, for the purpose of adapting it to the execution of criminals. I am quite sure that is the opinion of all the strong, earnest thinking electrical people, of those who are doing the world's work in electricity; and it is a pitiable thing when committees are appointed and courts of investigation take the matter up of seeing whether this new and useful and powerful and elegant agent can be prostituted to such purposes as the willful destruction of life. (Applause.)

On motion of Mr. Jarvis B. Edson, the president was authorized to appoint a committee of five to consider the suggestion made by the lecturer in regard to a library.

Mr. Garratt moved that the president appoint a committee to "consider the advisability of offering prizes for papers to be offered before this Club; that is, to open this Club to competitive papers, the committee to consider those papers, and prizes to be offered for the most excellent ones."

Mr. Tomlinson: I would suggest, as an amendment to the motion, that the address of Dr. Waldo, when printed, be referred to the board of managers with instructions that they report back to the next meeting of the Club some plan of action having in view the carrying into practical effect the suggestions made by Dr. Waldo. I do this, to make the motion more comprehensive than has just been suggested, for I think there are a great many recommendations in the lecture of Dr. Waldo which should receive very careful consideration. I mean in addition to the suggestion of a library and to the suggestion of prizes for papers. My mind is directed chiefly to a suggestion which ran through his entire address, that this Club, as a club, should occupy a more definite position than it does and take a greater interest in the various matters that may become the subject of legislation.

The amendment was accepted by Mr. Garratt and unanimously prevailed.

On motion of Mr. Edson, a vote of thanks was extended to Dr. Waldo for his address.

The President: It has been customary, I believe, on the occasion of our first meeting, to present a report of the condition of the Club. Many of our members have been away this season in Europe a longer length of time than usual and for that reason this work has been delayed, and at our next meeting such a report will be presented, and I think it will be gratifying to the members of the Club.

The meeting then adjoined. A very pleasant social hour followed, in which some delightful singing by Mr. Carl E. Dufft, of New York, accompanied by Mr. Albert J. Holden, greatly added to the enjoyment of all. The lunch served in the up-stairs dining room was not neglected, and the Club's reputation in this department of its entertainment scored another success.

All in all, the first meeting was a most pronounced success, and will undoubtedly be followed by many more of a similar character.

Endless Belt Multiple-Spindle Device of the Dwight Slate Machine Company.

Every electrical factory in this country, and their numbers are rapidly increasing, is interested in the development in the manufacture of drilling machinery. The electrical manufacturer appreciates the fact that this is one of the most important items of expense to be met with, and he is constantly on the lookout for improvements that will save time and labor. The drill user will be interested in the three-spindle drill illustrated in the REVIEW this week. It is intended to meet the wants of those who desire a movable table operated by hand or foot labor, and has just been put on the market by the Dwight Slate Machine Company, of Hartford, an establishment that has become very popular in electrical manufacturing circles on account of the accuracy and reliability of the goods sent out. A novel feature of the drill shown is the method of driving the spindle. This is accomplished by means of an endless belt some 18 feet in length so arranged as to drive all the spindles. To provide for "take-up" of the belt necessary from wear or change of atmosphere, two movable tightening pulleys are provided. The advantages of this arrangement will be at once seen. The single long belt takes the place of the many short ones usually employed, and being endless, runs smoothly and without the annoyances resulting from vibrations caused by the lacings passing over or around the pulleys. In addition, the belt has a contact of one-half to two-thirds the circumference of the driving pulleys, thereby insuring a continuous steady motion in spite of any variation in the work, this result being obtained with a minimum of belt tension.

The Electrical Industry and the Eleventh Census.

[Written for the ELECTRICAL REVIEW.]

Ever since a census of the people was taken by Moses, in the wilderness of Sinai, more than 3,300 years ago, peoples, when civilized, have made some effort to count their own numbers; ever since the days when Servius Tullius in Rome, about 1,000 years later, collected statistics of the people, thinking minds have been interested in the study of man in a social state, by the systematic arrangement of figures representing his deeds and possessions.

Strange indeed that an art so old should have remained in an undeveloped state so long, but it is a fact that until the present century the art of using statistics for the purpose of restrictive and protective legislation has scarcely been a factor in social or political systems; and to-day—as may be seen from the conflicting and confusing opinions rife even in legislative and judicial halls—we have not yet learned to unfailingly draw the same deductions from the same data.

That portion of our population which has been engaged in the various branches of electrical industry has had no time to keep record of what has been done, until at the present time we only know in a general way that several hundred million dollars have been invested and several tens of thousands of persons are employed. Some of us, for whom the subject has had more than usual interest, have devoted much of our individual time to the collection of electrical statistics, and the figures as far as they go are as accurate as most statistical figures, yet we have but touched the whole subject which is to all of us largely *a terra incognita*.

The National Electric Light Association in its wisdom has chosen from its members one whom it believed peculiarly fitted for the work, and has recommended to the General Government to set him at work collecting electrical statistics to be published as part of the census reports of 1890. The General Government has acted upon the suggestion of the Association and the electrical fraternity awaits with interest the results.

It would be inappropriate for the present writer to suggest the method by which these statistics shall be compiled, for although it must differ in some minor details from the method employed in the statistics of any other branch of industry, yet the general principles and methods observed by all statisticians will hold good. It is however appropriate for us to discuss *what* information shall be collected, and nothing will aid the government statistician more than a thorough discussion of this whole subject in the electrical journals.

The writer has for some years held concrete views in regard to the statistics of this industry, which are undoubtedly open, and are here advanced for friendly criticism and discussion. They are as follows:

The whole subject should be first separated into five classes, to wit: Class I. The number of corporations, firms and individuals engaged in electrical pursuits. Class II. The capital invested in electrical industries. Class III. Earnings of persons engaged in electrical pursuits. Class IV. Gross earnings of electrical apparatus. Class V. Materials used in the electrical industries. These five classes should be distributed into sub-classes, these into divisions, and these into sub-divisions, which again in some cases must be still further distributed. In each distribution there should be the smallest possible number of groups which will permit of an unmistakable and unconfusing classification, each group to contain the greatest number of kinds of similar things. This may be best explained by referring to the accompanying Tabular View. Class I is here seen to be first distributed into four sub-classes, viz: 1. Manufacturing. 2. Operating. 3. Educating. 4. Insuring. And it is at once evident that each of these sub-classes must be distributed into three divisions, viz: A. Corporations; B. Firms; C. Individuals, etc. We have now got Class I distributed into 12 divisions, and so far the work has been simple. Great care must now be observed in still further distribution, following the principle already

laid down that the groups must be as few as is consistent with a thorough classification. Each one of these sub-divisions must be accurately defined; as for example Subdivision 1, Signaling Apparatus, must be restricted to those electrical devices which produce sound and sight signals, excluding sounds and signs which stand for alphabetical characters and articulate speech. Subclass. 2. Telegraphic Apparatus, should be restricted to those devices which produce or transmit (excluding conductors and generators) at or to a distance, (by printed or impressed characters, flashes or moving spots of light, moving pointers, or sounds,) sensual impressions which stand for alphabetical characters or words. It should also include those devices for transmitting and receiving hand writing and drawings. Sub class 3 should include all transmitting and receiving apparatus for signals, which reach us through the auditory nerves in the shape of articulate speech, the signal having been transmitted electrically through a conductor or by electro-magnetic induction through space. Subdivision 4 should include all stationary electric motors not directly used in Sub-divisions 1, 2 and 3. For example, a telegraphic sounder is an electric motor pure and simple, yet by virtue of its exclusive use as a device for receiving signals standing for alphabetical characters, it belongs in Sub division 2. Sub-divisions 5, 6, 7, 8 and 9 need no special definition, as they are in themselves sufficiently specific. Sub-division 10 should include not only conductors pure and simple, as for example bare copper and iron wire, but also insulated wires, for it is evident that the function of a conductor is only to offer a path for equilibrating differences of potential, and anything which surrounds such a path for the express purpose of confining the resulting current within bounds becomes part of the conductor. It is evident that some insulating materials are manufactured for the purpose not of determining the paths of currents, but simply to prevent the current from taking certain paths; as for example glass and porcelain insulating knobs of all kinds, blocks, sheets, etc., of hard rubber and similar materials. These properly fall within Sub-division 11; though electrical resistances as, for example, German silver wire and certain forms of carbon should properly fall within Sub-division 10, for they form intentional paths for electric currents. Sub-divisions 12, 13 and 14 offer no particular complications, for their limits are well defined. Thus we see that we have distributed Division A of Sub-class 1 of Class I into 14 sub-divisions, and if we should distribute the other 37 sub-classes the same way, we should have in all 532 headings into which the final figures of the census gatherers would be divided. Fortunately this will not be necessary, though the number of headings will probably be quite large, as many as 148, leaving out any distribution of the subject of Insurance. (See Sub classes 4 and 6.)

The footings should read for each degree of distribution; for example, the total enumeration of Class I should be given, then the total of Sub-class 1, then the total of Division A, and, finally, the footing of its Sub-divisions. This should, of course, be done with all the other classes, sub-classes, divisions and sub-divisions.

One of the first things which will occur to the general reader is the apparent difficulty of anything more than the most general subdivision; for example, it may be said that although there are those who manufacture exclusively arc light apparatus and those who manufacture only incandescence apparatus, and those who manufacture only stationary motors, and those who manufacture only loco motors, yet there are also those who manufacture all of these various kinds of apparatus under one establishment. This is, of a truth, a difficulty, but like most difficulties it is only an obstacle which by effort can be overcome. To go into an explanation of the methods of doing so would be to write a treatise on that branch of the subject known among statisticians as geometrical averages, which is not the object of this article.

Sub-classes 2 and 3, with their six divisions and 44 sub-divisions, offer no specific difficulties, though it is evident that each subdivision should be very accurately defined before the final compilation of figures is attempted.

Sub-class 4 is a subject which should receive special treatment. It is the writer's opinion that the classification of the subject of insurance, which carries with it the subject of inspection, can best be accomplished by the aid and counsel of the "Committee on Harmonizing Electric Light and Insurance Interests," of the National Electric Light Association, of which committee Mr. P. H. Alexander, president of the New England Electric Exchange, is chairman, and of which Mr. Henry B. Cram, secretary of the same exchange, Mr. S. E. Barton, chairman of the electric light committee of the New England Insurance Exchange, Mr. M. J. Francisco, president of the local board of underwriters, and Mr. Marsden J. Perry, are members. If the writer is not mistaken, this committee also numbers among its members at the present time the chairmen of several other underwriters' associations, and it is through this source that the government statistician can receive the greatest aid in this difficult yet important branch of the subject.

Much of what has been said in regard to Classes I and II will apply to Classes III, IV and V, yet in each case the element of accurate definition must be pre-eminent, and the fidelity to fact in the arrangement and footing of quantities will determine the value of the work as a whole.

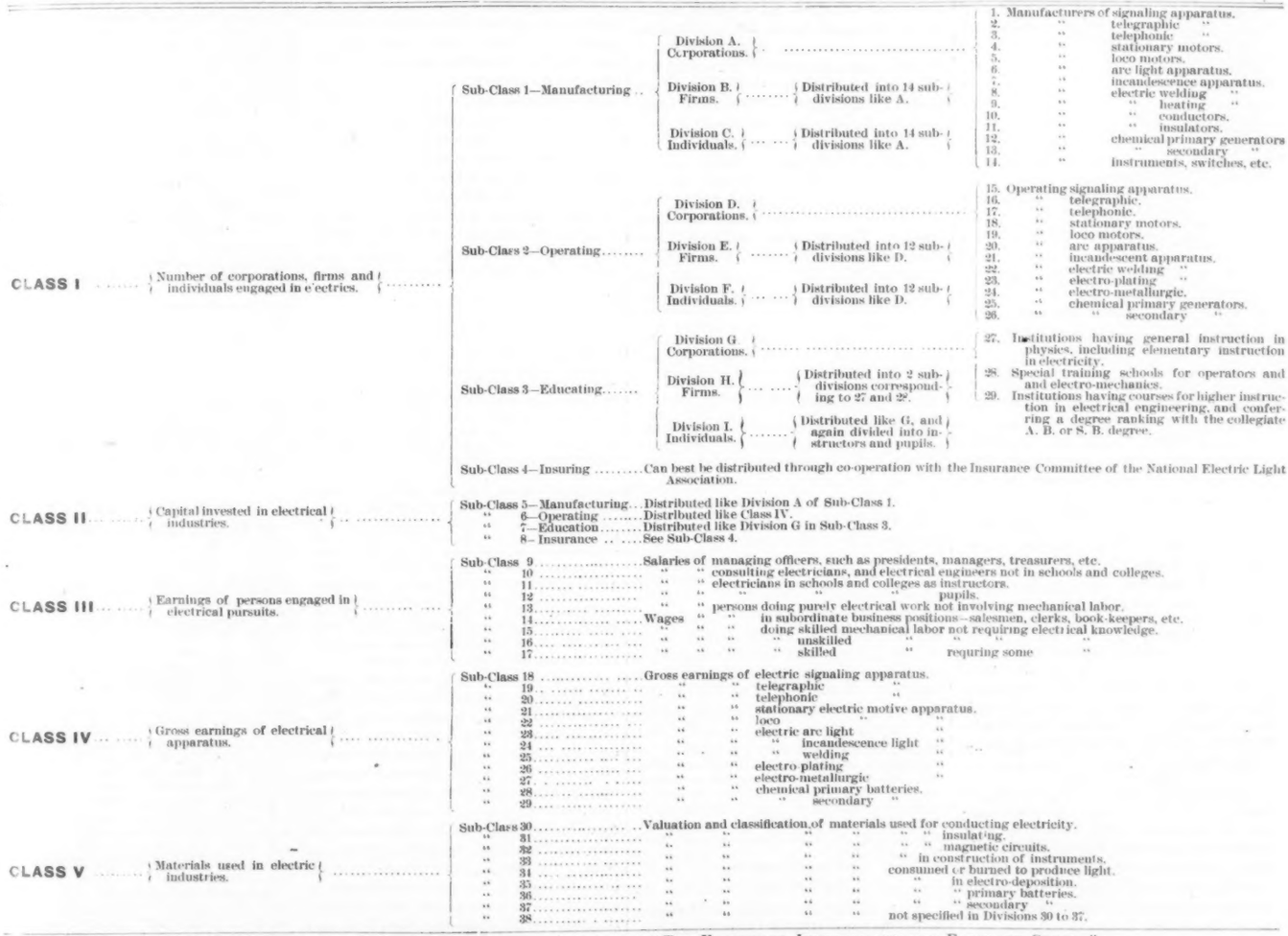
To compile the statistics of electrics in America is a stupendous undertaking which can only be accomplished under and by the control and aid of the National Government. Even then the results will not be thoroughly satisfactory unless each individual does his share by freely giving all the information in his possession, thereby holding up the hands of the government statistician, Mr. A. R. Foote, of Cincinnati, than whom no more fitting person could have been chosen for the work.

ALLAN V. GARRATT.

Chicago, Ill.—The Central Electric Company of Chicago filed a certificate of increase of capital stock from $50,000 to $250,000.

Carlinville, Ill.—The Carlinville Telephone Company, at Carlinville; capital stock, $25,000; incorporators, F. L. Bates, A. L. Given and B. M. Bates.

Merrimac, Mass.—The Merrimac Electric Company, to furnish light and power to the citizens of that town, has been incorporated under the general laws, with a capital of $10,000. I. B. Little is president and Thomas T. Robinson treasurer.


CLASS I
Number of corporations, firms and individuals engaged in electrics.
Sub-Class 1—Manufacturing
Division A. Corporations.
Division B. Firms.
Distributed into 14 sub-divisions like A.
Division C. Individuals.
Distributed into 14 sub-divisions like A.
1. Manufacturers of signaling apparatus.
2. " telegraphic "
3. " telephonic "
4. " stationary motors.
5. " loco motors.
6. " arc light apparatus.
7. " incandescence apparatus.
8. " electric welding "
9. " " heating "
10. " " conductors.
11. " " insulators.
12. " chemical primary generators
13. " " secondary "
14. " instruments, switches, etc.
Sub-Class 2—Operating
Division D. Corporations.
Division E. Firms.
Distributed into 12 sub-divisions like D.
Division F. Individuals.
Distributed into 12 sub-divisions like D.
15. Operating signaling apparatus.
16. " telegraphic.
17. " telephonic.
18. " stationary motors.
19. " loco motors.
20. " arc apparatus.
21. " incandescent apparatus.
22. " electric welding "
23. " electro-plating "
24. " electro-metallurgic.
25. " chemical primary generators.
26. " " secondary "
Sub-Class 3—Educating
Division G. Corporations.
Division H. Firms.
Distributed into 2 sub-divisions corresponding to 27 and 28.
Division I. Individuals.
Distributed like G, and again divided into instructors and pupils.
27. Institutions having general instruction in physics, including elementary instruction in electricity.
28. Special training schools for operators and and electro-mechanics.
29. Institutions having courses for higher instruction in electrical engineering, and conferring a degree ranking with the collegiate A. B. or S. B. degree.
Sub-Class 4—Insuring ..... Can best be distributed through co-operation with the Insurance Committee of the National Electric Light Association.
CLASS II ..... Capital invested in electrical industries.
Sub-Class 5—Manufacturing ..... Distributed like Division A of Sub-Class 1.
" 6—Operating ..... Distributed like Class IV.
" 7—Education ..... Distributed like Division G in Sub-Class 3.
" 8—Insurance ..... See Sub-Class 4.
CLASS III ..... Earnings of persons engaged in electrical pursuits.
Sub-Class 9 ..... Salaries of managing officers, such as presidents, managers, treasurers, etc.
" 10 ..... " " consulting electricians, and electrical engineers not in schools and colleges.
" 11 ..... " " electricians in schools and colleges as instructors.
" 12 ..... " " pupils.
" 13 ..... " " persons doing purely electrical work not involving mechanical labor.
" 14 ..... Wages " " in subordinate business positions—salesmen, clerks, book-keepers, etc.
" 15 ..... " " " doing skilled mechanical labor not requiring electrical knowledge.
" 16 ..... " " " " unskilled " " " "
" 17 ..... " " " " skilled " requiring some "
CLASS IV ..... Gross earnings of electrical apparatus.
Sub-Class 18 ..... Gross earnings of electric signaling apparatus.
" 19 ..... " " telegraphic "
" 20 ..... " " telephonic "
" 21 ..... " " stationary electric motive apparatus.
" 22 ..... " " loco " "
" 23 ..... " " electric arc light "
" 24 ..... " " " incandescence light "
" 25 ..... " " " welding "
" 26 ..... " " electro-plating "
" 27 ..... " " electro-metallurgic "
" 28 ..... " " chemical primary batteries.
" 29 ..... " " " secondary "
CLASS V ..... Materials used in electric industries.
Sub-Class 30 ..... Valuation and classification of materials used for conducting electricity.
" 31 ..... " " " " " insulating.
" 32 ..... " " " " " magnetic circuits.
" 33 ..... " " " " in construction of instruments.
" 34 ..... " " " " consumed or burned to produce light.
" 35 ..... " " " " " in electro-deposition.
" 36 ..... " " " " " primary batteries.
" 37 ..... " " " " " secondary "
" 38 ..... " " " " not specified in Divisions 30 to 37.

TABULAR VIEW ACCOMPANYING MR. GARRATT'S ARTICLE ON "THE ELECTRICAL INDUSTRY AND THE ELEVENTH CENSUS."

Monson, Mass.—An act of incorporation has been taken out by the Monson Gas and Electric Company, with a capital of $20,000, George H. Newton being president and Thomas T. Robinson treasurer.

New York City.—The capital of United Edison Manufacturing Company has been increased from $500,000 to $1,000,000, and a certificate to that effect was filed in the County Clerk's office yesterday.

Winchendon, Mass.—The Winchendon Electric Light and Power Company, of Winchendon, Mass., has been formed with a capital of $12,000. The following are the officers: Martin E. Converse, president; Waldo C. Corey, treasurer.

Chicago, Ill.—The Dearborn Elevated and Surface Electric Railroad Company, of Chicago; to operate an elevated and surface street railway by electricity. Capital stock, $12,000,000. Incorporators, Walter L. Session, Jr., H. H. C. Miller and David T. Corbin.

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The *Evening Sun* of this city says: "Electric lighting in this city must be made as safe as gas lighting." Has our sunset contemporary ever made a comparison of the deaths in this city resulting from gas and those resulting from electricity?

Simultaneously with the disappearance of the electric light in New York the life-destroying sand-bagger appears. Four citizens attacked in one week, three of them killed, and no arrests—of course New York is much safer to live in, now that our streets are lighted by gas.

The Brooklyn *Eagle* speaks of a social event where the house was "brilliantly lighted from basement to cellar." It might have added to the brilliancy had a few of the floors above the basement been lighted—unless Brooklyn cellars are on the roof.

At each succeeding meeting of the New England Electric Exchange its importance, and the importance of the work it is doing, are better recognized. The establishment of such organizations in various parts of the country, with careful management, would undoubtedly benefit the electric lighting and power industries.

We fail to see what the daily *World* of this city expects to gain by misquoting Dr. Waldo. The statements attributed to him appearing in the *World* as a direct quotation, such as "death dealing currents," "greed of capitalists," "invoking the courts," "menace to human life," etc., were not uttered by the lecturer at the Electric Club, nor did they appear in the manuscript, a correct copy of which was given to the reporter of the *World*. An apology is due from that journal to Dr. Waldo as well as to its readers.

Last week was a pretty good convention week in the field of electricity. The REVIEW contains reports of the following meetings: American Street Railway Association, Railway Telegraph Superintendents, Western Electric Railway Association, Association of Sprague Agents, The Electric Club, and the Electric Exchange. Each of these organizations met last week, and the readers of the REVIEW will find in this issue a comprehensive account of the transactions of each.

The manufacturers of covered wire are disposed to resent the idea now so freely circulating in the daily papers that they cannot produce a thoroughly reliable insulated wire. There are fire and weatherproof wires manufactured by responsible companies. These companies, we believe, stand ready to guarantee their work. If such wire, which is of course more expensive at first, but not when its life is considered, had been in the market when electric lighting first began, the number of accidents, small as they are now comparatively, would have been less; and in addition, had the companies more generally used the improved wire when it was placed on the market, the list of accidents would probably have been *nil*. Let the electric lighting companies meet this question in a manly spirit, improve their lines wherever they are defective, and we predict the present outcry against the danger of electric lighting will soon entirely disappear.

A number—in fact a majority—of the members of the New York Assembly voted against the telephone bill reducing rentals below a reasonable figure. These gentlemen, or as many of them as there are hopes of reaching, are to be defeated for re-election if the actions of a scant half-dozen men, styling themselves the Board of Trade and Transportation, is to be regarded seriously. These self-sacrificing and, of course, unselfish and unprejudiced individuals are doing this, it is evident, first for revenge because the said members did not obey them before, and second because they want telephone service cheaper. They probably want many other things cheaper. We notice the name of C. C. Shayne, the furrier, as one committee man. Mr. Shayne, a greatly overcharged public would like to get its furs cheaper. It doesn't care whether your profits pay rent, wages, insurance, etc., and leave you a fine income or not—what it would like is to get seal skins at one-half your present price.

THE ELECTRIC CLUB.

The first meeting this fall of the Electric Club was most auspicious. The attendance was large, the address timely and progressive, and the spirit of the meeting was in favor of not only a continuance of the good work done by this organization in the past, but also in favor of widening the scope of the Club's work and increasing its usefulness in advancing the cause of electrical science.

There were many valuable suggestions in the address of Dr. Waldo, and it is but another evidence of the commendable intention of the organization that the address was referred to the managers of the Club so that these suggestions could be made the subject of a report at the next meeting. We hope to see the Club advance its standard all along the line during the lecture season of 1889-'90, and while it is prudent not to attempt too much, we believe that it is peculiarly adapted to lead in the march of electrical progress and become an organization of the highest character and most potent influence.

THE CENSUS.

Dr. A. V. Garratt, secretary and treasurer of the National Electric Light Association, contributes an article to the ELECTRICAL REVIEW this week in which the important matter of the relation of the electrical industry to the next census is comprehensively treated.

We believe, and such is evidently the opinion of our contributor, that the special agent of the Census Bureau in charge of electrical statistics, should be expected to investigate and report on the statistics of the entire field, and this plan will prove much better than the one which is now talked of at Washington, which places the telephone and the telegraph in the division relating to "transportation."

A capable man, Mr. A. R. Foote, of Cincinnati, has been appointed to do this work. His familiarity with the industry and his inclination for such work, particularly fit him for the responsible position he now occupies. We bespeak for him the earnest support and assistance of the electrical fraternity, and think that both he and Superintendent Porter will find a number of valuable suggestions in the article contributed to the REVIEW by Dr. Garratt.

THE ADVENT OF THE ELECTRIC RAILWAY.

No more significant utterance in relation to the progress of electricity has appeared in the past few years than the report of the committee on "Electricity as a Motive Power," presented to the American Street Railway Association at the Convention at Minneapolis, last week, and which appears in full on another page. After two years investigation and discussion a satisfactory answer is given, and it is almost needless to state the answer is a most favorable one. The report states, speaking for the street railways of the country: "We have established to-day without a doubt the success of electricity as a motive power," and then proceeds with a very interesting and exhaustive review of the situation. Among many other important points appearing in this report is one which appeals directly to the pockets of the stockholders of street railway companies. This is where attention is called to the fact that the use of electricity as a motive power for street railways not only increases the traffic, but reduces expenses and enables a line to be operated at a profit which heretofore has entailed a loss. It will be observed that overhead and storage battery systems meet with the most approval at the hands of the street railway men, and as compared with the cable system it is stated that electricity as a motive power is as far ahead of that traction as the cable system was in advance over horses.

A report of the proceedings of the American Street Railway Association, and the interesting discussion of this topic, is presented in this issue of the REVIEW and will be of value to every reader interested in electrical progress.

COMMON SENSE IN DEMAND.

The return of New York to oil-light illumination is not very encouraging to braggers of our metropolitanism. It would seem to be about as sensible to stop the running of our surface cars because now and then a man is run over, or to stop the speeding of our steam cars because occasionally disaster results from carelessness or recklessness, as to plunge a city into darkness because a lineman undertook to do a work, attended with great danger, without providing himself with essential safeguards. We who regard with amazement the sudden passionate killing by assassins, we who wonder at the quick flashing anger of our children, appear to regard a wide-horizoned public flaming indignation as a matter of course. Common sense will ultimately come to the rescue through the calmness of judicial utterance—that is, if the cases are kept away from our sensational judges.—*Joe Howard in N. Y. Press.*

The above able writer has a broad-gauged way of looking at things that has had much to do with his high journalistic fame. He is very much to the point in the above. A few days ago a little boy had both of his legs cut off by a street car in this city and, after being cruelly carted around from hospital to hospital, died in agony; Mr. Joseph Richardson, 79 years of age, while attempting to get on a street car in the city of New York, last week, was thrown to the ground and his hip broken, and he will probably die; a team of horses was run into last week by a street car on Eighth avenue, New York, and ran away, running against and killing Mrs. Fanny Lucas, and severely injuring the two ladies in the carriage. Why is not the cry: "Stop the street cars until the possibility of danger to human life is removed?" This is but a record of a day or two in this city. How the list could be extended!

A little common sense, along with the jewel of consistency, are both needed in this city.

The experience of New York in being so cut off from electric illumination, has served to awaken other cities to the chances of a repetition of such a calamity in their midst. Boston, although remarkably free from accidents, considering the number of overhead wires and the introduction of street railways on the overhead wire system, has nevertheless taken steps, through the Electric Exchange, to have the authorities remove "dead" and "tramp" wires, and has also taken steps to call to the attention of the authorities the necessity of keeping politics out of the question in appointing electrical inspectors and commissioners.

ELECTRICAL NEWS.

What is Transpiring in Electrical Circles in the Leading Cities.

OUR CHICAGO LETTER.

The Knapp Electrical Works have installed a 100 light incandescent machine on the circuits of which will be shown upwards of 150 Perkins lamps.

The Belding Motor Company has been reorganized lately. The present officers are as follows: Thos. G. Crosby, president; Albert F. Dexter, vice-president; W. S. Gooding, secretary and treasurer; Warren S. Belding, electrician. The company are looking for agents to represent them in all cities, and in the future will push their business all that is possible.

An Electrician Surprised.—A very pleasant surprise party was given to Mr. B. E. Sunny, of the Thomson-Houston Electric Company, at his residence, 138 Mastin street, on Friday evening, October 18th. A most enjoyable evening was spent. Mr. Sunny had not the slightest intimation that the party was to be given, and greatly was he surprised when at eight P. M. the door bell rang and the many guests were ushered in. The following were present: S. A. Barton, C. N. Fay, Prof. J. P. Barrett, J. W. Buell and wife, A. L. Prentice and wife, W. A. Kreidler, F. W. Horne and wife, J. L. Martin and wife, D. P. Perry and wife, J. W. Brun, F. W. Townsend and wife, H. S. Manning, H. H. Snall, C. H. Willmerching, F. W. Cushing, A. Janpolis, J. J. Nate, F. G. Beach, Alexander Kempt, W. J. Buckley, Elmer A. Sperry and wife, G. W. Conover and wife, C. S. Colton, Jesse Scribner, F. L. Stagg, J. C. Baker, Arthur Dement, J. W. Dickinson, C. F. Clark, H. A. Douglass and wife, F. H. Sodon, H. J. Sinclair, F. E. Degenhardt and wife, Misses Buckley, Thompson and Hobert. During the course of the evening Mr. Sunny was presented with a beautiful onyx stand.

The Electrical Supply Company has just issued a perfect and complete illustrated catalogue of everything in the line of electrical supplies, tools and appliances that can be asked for. But what renders the catalogue particulary valuable is the profuse tabulated information, including dimensions, resistances, weights and safe carrying capacities of wires, wiring table for 50, 75 and 110 volt lamps, and a large variety of kindred imformation which would be difficult to find elsewhere in the same compact and convenient form. D. B. D.

Chicago, Oct. 19, 1889.

OUR BOSTON LETTER.

The Harvard University Electric Club now numbers 38 members, has its own headquarters, and is otherwise in a flourishing condition. A regular series of papers has been arranged, the first on "Transformers," by G. T. Page, having already been read. Mr. G. T. Chittendon will read the next paper, and, in November, Prof. Trowbridge will address the club.

The New England Weston Company has been busily engaged, in the last two weeks, in installing additions of electric lighting apparatus to many of their already existing plants. At the Lowell, Mass., Manufacturing Company 600 lights have been added: at the Nourse Mill, in Woonsocket, R. I., 200 lights. An interesting installation is in the Boston Manufacturing Company's mill at Waltham. This is the oldest cotton mill in the world, in which weaving and spinning is done under one roof, and both operations are still carried on not only under one roof, but also under the soft effulgence of incandescent electric lamps.

An Insulating Coupling for Fixtures.—Mr. Erick E. Erickson is the inventor, and the Erickson Insulating Coupling Company, of this city, the manufacturers of a new insulating coupling for combination electric light and gas fixtures. The coupling is made of a strong insulating material, in one solid piece, in the form of an hexagonal nut with threaded brass bushings cast in each end, of any required size for gas pipe and fixtures. Such is its strength and solidity that an ordinary wrench may be used in manipulating it, and as there are no screws, washers, or auxiliary parts, there is no chance of grounding the current or any escape of gas. This little piece of apparatus has a large field, and will doubtless meet with a large sale.

A New Motor Hour Register.—Mr. Hollin C. Spaulding, manager of the Thomson-Houston Motor Company, has just received his patents for a new time registering and recording apparatus for dynamo electric machines. By the use of this little machine power companies may rent electric power by the horse power hour. The special advantages of Mr. Spaulding's apparatus is that it is attached directly to the motor, leaving no chance for severing the wires or disconnecting the recorder, as is the case with registers placed at a distance and connected with wires. The register is sealed by the inspector when he makes his rounds, and the seal remains unbroken until the time of his next visit, when the exact number of hours the

motor has been in operation during the time will be shown.

The Thomson-Houston-Brush Transaction.—The practical sale of the Brush Company to the Thomson-Houston, which was reported in this city on Tuesday morning, has been the electrical sensation of the day and has been the subject of conversation wherever electrical people have met. The report was a perfect surprise on all sides and for once no knowing ones are to be found with their ever-ready "I told you so" and "We've expected this for some time." Every one was ready to confess his genuine surprise.

Ask for Electric Train Lighting.—The grand council of the Steam Railroad Men's Protective Union has been in session in this city and, among other business transacted, a letter was gotten out asking among other things that all passenger trains be lighted by electricity.

Eastern New England Agency.—Messrs. Claflin & Kimball, the agents of the Mather Company, are also the Eastern New England agents for the Perkins Lamp Company. The Perkins Company is already doing an immense business, principally in the West, but under the new arrangement, the New England business may safely be expected to boom. The firm has recently installed several Mather plants in this vicinity, some of the more important being one of 400 lights for the Knowles' Loom Works, Worcester, Mass.; 250 lights for the Berlin Mills Company, Berlin Falls, N. H.; two 200 light machines for the Cooledge Building, Boston, and a 250 light increase for the Church Green Company, Boston. Mr. Claflin has been confined to his house for several weeks, suffering from a slow fever, but is now convalescent and expected back at his desk within a short time.

Notes and Items.—The New England office of Chas. A. Schieren & Company has been moved from Federal street to 119 High street.

Mr. Isaac H. Davis, one of the resident representatives of Westinghouse, Church, Kerr & Company, has just returned from a ten weeks' European tour.

Mr. Robert Huston, the Eastern agent for the Heine Safety Boiler Company, is about removing his office from Oliver street, this city, to 239 Broadway, corner Park Place, New York.

The Thomson-Houston Motor Company has established an engineering department. This necessitates more room, and Mr. Spaulding now occupies the corner room of his suite for his private office. The room is illuminated with incandescent lamps in some very novel and pretty fixtures from Oxley, Giddings & Enos.

The Marr Construction Company has contracted through its New England manager, Mr. H. C. Hawks, for a 50 light plant at St. Paul's school, Concord, N. H., and a 50 light plant for the Boston Steam Heating Co.

Messrs. Newton and Baird, of the Eddy Motor Company, were in town last week.

Mr. O. S. Hussey, of the T.-H. Motor Company, has just returned from an enjoyable wedding trip.

Mr. S. M. Hammill, of the Brush Company, was a Boston visitor last week.

Dr. Mason, of the Simplex Company, has been absent several days in the West.

Boston, Oct. 21, 1889. T. W. S.

OUR WASHINGTON LETTER.

An Accident.—Baltimore was lately the victim of an accident which exhibited the queerest phenomena that I have ever known. By the breakage of one of the electric light wires, and a consequent crossing of other wires, several switchboards were burnt out and other damage inflicted; but the queerest feature of the case is that witnesses state that there appeared on the end of the broken wire a ball of fire that shocked and drove them from the place, and was not abated until the current was shut off. If Baltimore has a professional affidavit maker here is a chance for him; we, of Washington, have many direct and alternating current dynamos, but globular lightning is not in our line.

Stock Market.—Securities in the electric companies are well appreciated in the District, as is shown by the following quotations obtained at this writing: Electric Light, 1st 6s, 100 bid, 105 asked; 2d 6s, 100 bid, 103 asked; Pennsylvania Telephone Company, 23½ bid; Chesapeake and Potomac Telephone Company, 86¾ bid, 88 asked.

Mr. C. P. Gleim, one of the engineers of the United States Company, is here from New York to overhaul and put in order the electric light plants at the Capitol, preparatory to the next session of Congress. There is a Westinghouse plant on the Senate side, and a Thomson-Houston Sawyer-Man plant on the House side. Mr. Gleim very ably ran the plant on the House side last winter, and got every watt out of the dynamo that it was possible to get. His company is to be congratulated upon having in its employ so capable and efficient a man.

Notes.—The Chesapeake & Potomac Telephone Co. have declared a dividend of $1.25 per share. The Common Council of Alexandria, Va., are in a snarl over the electric lights.

G. E. M.

Washington, D. C., Oct. 19, 1889.

PERSONAL.

Mr. L. H. Korty, of Omaha, was a western visitor in the metropolis last week. Mr. Korty is one of the pioneer telegraph and telephone men of the West, and came East to attend the meeting of the Railway Telegraph Superintendents at Washington.

Mr. W. B. Sommerville, the well-known Western Union official, recently returned from a pleasant visit to the Paris Exposition much improved in health. It seems that all the electrical workers visiting the Exposition have returned in better health and added to their avoirdupois.

Mr. Cyrus O. Baker, Jr., of Baker & Co., Newark, and one of the board of managers of the Electric Club, will sail for Paris on the French steamer, "La Gascogne," Saturday, of this week, the steamer sailing at 6 A. M. Mr. Baker will arrive in time to see the closing days of the great Exposition.

Mr. R. H. Sherwood, formerly assistant general manager of the Excelsior Electric Company, New York, has resigned to accept a position with the Thomson-Houston Electric Railway Company. Mr. Sherwood will make his headquarters at the Thomson-Houston offices in this city at 115 Broadway.

Mr. F. S. Terry, manager of the Electrical Supply Company, Chicago, and treasurer of the Electric Club of that city, was visiting New York friends last week. Mr. Terry deserves much credit for the large electrical business he has built up in the West, and has to-day one of the best equipped electrical supply houses in the country.

Mr. Henry J. Conant, of the Evans Friction Cone Company, Boston, was a New York visitor last week. The Evans system of belting was recently illustrated in the REVIEW and is attracting attention in electric lighting circles. A station in New England equipped throughout with the Evans system will soon be in running order.

Mr. Chas. F. Cutler's daughter, Jennette, and Mr. James Breckinridge Curtis, of Indianapolis, were married at Morristown, N. J., Tuesday, of last week. Mr. and Mrs. Curtis will reside in Indianapolis. There were a number of the telephone friends of Mr. Cutler present who, with others, attended the reception afterwards at Mr. Cutler's beautiful residence, at Kahdena.

The New England Electric Exchange.

The regular quarterly meeting of the New England Electric Exchange which was held at the rooms of the Boston Electric Club on Monday, October 14th, was well attended and proved an important one in the history of this rapidly growing organization. President P. H. Alexander was in the chair, and in a few introductory remarks stated that on and after November 1st, 1889, the New England Insurance Exchange will require all persons installing or operating electric plants or doing inside wiring, to hold a license of the Electric Exchange. Mr. H. B. Cram, who has served the Exchange industriously and well as its secretary and treasurer, presented reports in his dual positions, which are here given:

TREASURER'S REPORT FOR THE QUARTER ENDING OCTOBER 14, 1889.

RECEIPTS.

Cash received from the unincorporated N. E. Elec. Exchange, July 8, 1889.	$252 56	
Annual dues from 14 members	70 00	
License fees from 80 applicants	160 00	
License renewal fees from 50 applicants	100 00	
		$582 56

DISBURSEMENTS.

Examination Expenses:		
New Haven, Conn.	$20 08	
Waterville, Me.	41 80	
Springfield, Mass.	24 23	
Rutland, Vt	47 15	
	$133 26	
Stationery, postage, printing and telegrams	57 98	
Telephone to Nov. 1, 1889	30 00	
Clerical services	31 90	$253 14
Balance of cash on hand		$329 42
There is due:		
Annual dues for 1888-'89 from 1 member	$3 00	
Annual dues for 1889-'90 from 29 members	145 00	
And as there are no unpaid bills, there would be in the treasury, if all dues were paid, and including cash on hand, as above, of	329 42	
A total amount of	$477 42	

HENRY B. CRAM, *Treasurer.*

Boston, October 14, 1889.

The secretary's report was presented in the following fully tabulated and analytical statement, covering the entire work done by the Exchange since its inauguration up to date:

LICENSE STATEMENT. OCTOBER 14, 1889.

Class.	Applied.	Granted.	Rejected.	Exam. but Not Ex.	not dis-posed of.
1	71	32	1	15	1
2	93	44	2	17	7
3	30	21	3	8	1
3B	...	8	1		
4	34	50	1	9	7
5	48	36	...	18	1
Not given	13	...	3	4	
	289	191	11	71	17

Total number of applications	289	
Re-examination granted without application	1	
		290
Total number of Licenses granted and certificates issued	191	
Applications rejected	11	
Applicants not examined	71	
Applicants examined but not finally reported	17	290

One of the above 191 certificates has not been issued as it is without the Insurance Inspector's approval, which is withheld on a question of character.

Second Applications.				Granted on Second Applications.			
Class 1	2	Not Examined.	3	Class 1	1		
2	8	Class 2	3	2	1	Rejected	
3	2	3	1	3	2	Class 1	1
4		Not given.	1	3B	1		
5				4	2		
Not given.	1	5		5			
	13				7		

Rec'd Licenses of higher class than appl'd for	5	
" " lower " " "	78	
" " same " " "	104	
" " when no class was named in application	4	191

Of the 11 Applicants rejected 1 applied for 1st class.
2 " " 2d "
3 " " 3d "
1 " " 4th "
1 " " 5th "
3 " " Not given
11

Licenses renewed for one year	18	
Applications for renewal of License received but not acted upon	32	
Total number of renewals applied for	50	
Of the above number of applicants not examined	71	
There have died	2	
Leaving total number of applicants to be examined	69	

HENRY B. CRAM, *Secretary.*

In reading his reports the secretary gave reasons why so many candidates are still waiting for examination, and stated that the membership of the exchange itself has increased since the July meeting.

On motion of Mr. Frank Ridlon it was decided to hold two examinations weekly until November 1, in order that all who so desire may undergo the examination, and Mondays and Thursdays were fixed upon as the days. In view of the large amount of time demanded of the secretary, and the treasury warranting, it was decided to appropriate $200 as a slight compensation.

Captain Brophy, the New England Insurance Inspector, spoke of the recent fatal accidents in New York with the opinion that there was not the slightest reason for the trouble if the matter of insulated wires were only in the hands of competent men. On motion of Mr. H. C. Spaulding a committee was appointed to look up the subject of establishing courses of instruction preparatory to the exchange examination. On motion of Mr. Ridlon a committee was appointed to bring before the city authorities and New England legislatures, the necessity of keeping politics out of the question in the appointment of electrical commissioners, inspectors, etc.

After the appointment of another committee, to urge all electric light companies in New England to join the exchange, the meeting adjourned.

Gas Lighting and Extinguishing by Electricity.

At the close of Wednesday afternoon's session of the Baltimore Gas Convention, some 30 or 40 members of the Association accepted an invitation by the Universal Gas Lighting Company, of New York, to inspect several blocks of street gas lamps, which they had equipped with their system of lighting and extinguishing street gas lamps by electricity. Carriages were taken to Park avenue and Franklin street, where a practical demonstration of the work of this company was given.

The street lamps on the several blocks were lighted and extinguished over and over again, and they worked perfectly every time. Those present were very much pleased with the working of the new burner, and a number expressed themselves ready to give the new system a trial. The company expects to have a line of posts equipped at Newton, Mass., early next month, and several others before the first of December, as they have a number of orders on hand.

In addition to a saving in labor of about 30 per cent. it is claimed there is a saving in gas of quite 2,000 feet per lamp yearly, this in itself being a very important item. This company has its offices at 853 Broadway, New York City.

The Electric Lighting Situation in New York.

Monday of this week the two local companies, the Brush Illuminating and the United States Illuminating, were still not supplying arc electric lights. These companies are rapidly improving their lines, pending the decision in their injunction cases against the Board of Electrical Control.

The East River Electric Company, using the Thomson-Houston system, both arc and alternating, and the Manhattan Electric Company, using the Fort Wayne arc and Slattery alternating systems, have been running constantly, the former supplying 600 arc and 4,000 incandescent lamps. These companies, comparatively new comers in the field here, did not have to contend with the poor construction of early electric lighting days, but have built their lines of the best modern fire and weatherproof wires and have seen that the work was approved by the proper authorities. From what we have seen of the construction done by the East River Company under the direction of General Manager John G. Moore, it is evident that neither expense nor pains have been spared to make the lines safe, and not a single accident, to our knowledge, has been recorded against them. The joints—those points of danger—are triple coated with black tape, which is securely tied on each side of the joint with fine wire, so that peeling off becomes almost impossible. Another point is in the specially made cross-arms, in which the pins are set out from the pole on each side, giving the lineman more room in his work.

The older companies in their later work have realized the necessity of the best construction, and if permitted to proceed with the work now commenced will soon have all their lines overhauled. There is still a great deal of the construction of early days that will have to be changed. There are several reasons why this change has heretofore been a slow one—the chief one being, probably, the expectation of soon being compelled to go underground. Then, besides, it is claimed that it was very difficult to get permits to repair lines that needed attention, and many points of danger caused by bare wires resulted.

The electric lighting interests of the country need not feel discouraged over the situation here. There have been some serious accidents, and the public has been badly scared, yet we think when every facility for perfect overhead construction has been adopted, there will be no accidents and the danger reduced to the minimum.

Mayor Grant, in his opposition to the resolution reducing the pressure to 300 volts for alternating currents and to 700 for continuous currents, deserves the thanks of every one who believes in electric lighting and its good work irrespective of any systems. Such action would be most unjust and unnecessary. Modern construction, carefully and regularly inspected, is what is needed. All the accidents so far were preventable ones.

Important Move in Electric Lighting Circles.

REPORTED SALE OF THE BRUSH COMPANY, OF CLEVELAND, TO THE THOMSON-HOUSTON ELECTRIC COMPANY.

A large majority interest in the Brush Electric Company is said to have been purchased by the Thomson-Houston Electric Company. The practical purchase of the parent Brush Company will place the Thomson-Houston in full possession of all the Brush patents, and in a position to dictate the future policy of the Brush Company. The control will probably cover the electric lighting business, also the carbon business and the supply of all stations now operating the Brush plants. The entrance of the Brush Company into the alternating current field placed it in direct competition with the other alternating systems, and the purchase would remove this competition and strengthen the patents of the Thomson-Houston Company.

Until an official statement comes from the companies interested, the closing of this important deal cannot be positively announced.

Incandescent Plant Wanted.

The Kentucky Union Railway Company, at Clay City, Ky., are in the market for a complete incandescent plant of 800-light capacity. The company that gets this order will probably find several others waiting for it in the same neighborhood.

Telephonic News

⁂ It is stated that the 3,200 telephones in Detroit, Mich., are used 80,000 times a day, and give employment to 60 young women. Five 'phone girls operate the state line, which transmits 550 messages per day.

⁂ The Federal Telephone Company, of Montreal, Canada, commences operations within two weeks from present date. Already employés are being taken on, and it is expected that all arrangements will be completed within the time mentioned.

⁂ The Western Union Telegraph Company, of Atlanta, Ga., have purchased the private telegraph wires of the Georgia Pacific Railroad, between Atlanta and Columbus, Miss., and the right to operate lines along the railroad. The line is nearly 300 miles in length.

⁂ An Atlanta, Ga., paper says: "The Western Union has purchased the Georgia Pacific Railroad Telegraph line from Atlanta to Greenville, Miss., a distance of 500 miles. Price paid not given. This will give the company two direct wires to New Orleans over widely diverging tracks of country."

⁂ The telephone company at Chattanooga, Tenn., claim that they will have the best system in the South within the next 30 days. Their new switchboard is one of the most complete and perfect in use, and the way in which the wires will reach the switchboard in the new office in the Montague block will guarantee much better service, and enable the company to prevent the wires coming in contact with other wires, as they now do. It is believed that everything will be in first-class working order within the next 30 days.

The Telephone as a Cause of Ear Troubles.

The *British Medical Journal* says: "As civilization advances new diseases are not only discovered, but are actually produced by the novel agencies which are brought to bear on man's body and mind. The increase of insanity throughout the world is unquestionably due to the 'storm and stress' of our crowded modern life, and almost every addition which science makes to the convenience of the majority seems to bring with it some new form of suffering to the few. Railway travelling has its *amaria aliquid* in the shape of slight, but possibly not unimportant, jolting of the nervous centers; the electric light has already created a special form of ophthalmia; and now we have the telephone indicted as a cause of ear troubles, which react on the spirits, and indirectly on the general health. M. Gellé has observed, not in women only, but in strong-minded and able-bodied men, symptoms of what we may call 'aural overpressure,' caused by the condition of almost constant strain of the auditory apparatus, in which persons who use the telephone much have to spend a considerable portion of each working day. In some cases also the ear seemed to be irritated by the constantly recurring sharp tinkle of the bell, or by the nearness of the sounds conveyed through the tube, into a state of over-sensitiveness which made it intolerant of sound, as the eye, when inflamed or irritable, becomes unable to bear the light. The patients suffered from nervous excitability, with buzzing noises in the ear, giddiness and neuralgic pains. In addition to these subjective symptoms, M. Gellé in some cases found objective lessons, such as a sub-inflammatory condition of the membrana tympani. A similar condition of things is often seen in persons who spend a large portion of their lives amid the jar and crash of machinery. All the trouble speedily vanishes if the ear is allowed a sufficient measure of physiological rest; this it can only obtain by the cause of the evil being withdrawn."

The Minister and the Telephone.

An amusing anecdote is told in *The Telephone*, London, about the recent experience of Baron von Mittnacht, the Wurtemberg Minister-Prefect, with the telephone. His Excellency was lately paying a visit *incognito* to his son at Ulm. Whilst inspecting the sights of the town, in company with his relative and a Hamburg Senator, he went, at the request of the latter, to the post office to try the new telephone connection between Ulm and Stuttgart. After ringing and asking to be connected with the foreign office at that town, the familiar voice of the Chancery servant was heard asking in broad Wurtemberg dialect, "Who is there?" To Herr von Mittnacht's reply—"Minister-President Mittnacht"—there came the impatient answer, "You be blowed; don't try and green *me*; the Minister-President is not at Ulm." His Excellency replied, "Yes, I am here; call Councillor B. to the telephone." The servant would not believe the voice of the Minister, and gave the well known evasive answer, "All the gentlemen have gone out." The Minister's angry order had no effect. The servant at length broke off the communication, after a final asseveration that his interlocutor was quite a different person from what he professed to be, and that he was not going to be caught so easily. Only a few days before this functionary was bowing in the most servile and deferential manner before the high dignitary whose voice he could not recognize through the telephone wire.

Suits Against Western Union.

Judge Dennis, in the Circuit Court at Baltimore last week, began the hearing of the bill filed by John H. B. Latrobe and others, representing about $80,000 of the stock of the Western Telegraph Company, of Baltimore City, against the Western Union Telegraph Company, which is holding off about $90,000 of the stock of the same company. The object of the suit is to obtain a decree declaring that the stockholders of the Western Telegraph Company of Baltimore City are entitled to the physical structure (poles, wires, insulators, etc.) of about 400 miles of the telegraph line extending along the line of the Baltimore and Ohio Railroad from Baltimore to Wheeling, W. Va. The bill also asks for the appointment of a receiver to take possession of the physical structure and dispose of it for the benefit of the stockholders, and for an account.

The bill states that a suit was instituted, with a similar object in view, against the Baltimore and Ohio Railroad in 1885, in which the Western Union united, but, pending the trial of the case in the Court of Appeals, the Western Union purchased the Baltimore and Ohio telegraph system, which purchase put it in possession of the property in controversy. It then withdrew from the litigation, which had become practically directed against itself, and at its request the Court of Appeals refused to consider the question of ownership of the physical structure. The Western Union asserts, in its answer, that the poles and wires are practically of no value if removed, and that it is under no obligation to the minority stockholders to account to them for the value or use of them. It is alleged by the plaintiffs that it would cost the Western Union about $250,000 to build a new line between the points named, if the court allowed the present structure to be removed.

Philadelphia, Oct. 16.—The city's suit in the United States Circuit Court against the Western Union Telegraph Company, to recover license fees of $1 a pole and $2.50 on each mile of wire, for the years 1885–'88, ended to-day in a verdict for $14,438.43 for the complainant.

⁂ The committee appointed recently by the San Francisco Chamber of Commerce to investigate the feasibility of laying an ocean telegraph cable from that port to Australia has reported in favor of the project, and estimates the cost of a cable line to New Zealand by way of Honolulu and Tutuila at £2,000,000.

Electrical Notes of a Transatlantic Trip.

BY THOMAS D. LOCKWOOD, BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, OCTOBER 15TH, 1889.

TELEGRAPHY.

The London operating room, or rooms, is an immense affair. Heretofore I had a most exalted opinion of the size of the Western Union room in New York, but the London room was a decided revelation. I noticed a very peculiar effect there. When first introduced, a good sized room filled with operators, or more properly, telegraphists and apparatus dawned upon my vision; and together with Mr. Cooper and the superintendent in charge, I wandered through it; but near the end we suddenly turn a corner, and another vista, as wide and long as the first, appears which again we traverse, only to find once more as we approach its farthest limit that a third vast expanse lies before us, and so on apparently for half a dozen successive times. Then I was led upstairs where a similar succession of rooms was exhibited to my bewildered gaze.

Morse instruments, both sounder and ink writer, were there to be found. The single needle also appeared to hold its own, and I saw something new to me, viz: telegraphists reading by sound from the click of the single needle as it vibrated from one side to the other, striking its limiting stop.

With respect to the Morse, I do not think the average transmission is as fast as is the American average, nor do I think it possible to achieve extremely rapid sending with the heavy keys generally in use.

I was greatly interested with the way in which the Delany multiplex has been taken up by the British telegraphic authorities. It may have been in some degree improved and modified, and I understood that the number of circuits simultaneously worked successfully, were not as great as had been hoped for, but still it was in use; its use was increasing, it was doing good work on lines of considerable length, and the operators liked it.

Upon making inquiries about the Wheatstone automatic, it was to be noted that while authorities united in enthusiastic praise of its qualifications as a fast telegraph in all cases where the matter transmitted was to be received in duplicate or in multiple, such as news, the praise was by no means so emphatic with respect to its ordinary use as a means of transmission for business messages, as so much time was required to be taken up in the preliminary measure of punching.

The pneumatic despatch branch of the London station is on an equal scale of intensity, and in fact is one of the great features of London telegraphy. Throughout the length and breadth of the land, I found civility and prompt attention in the matter of receiving and delivering telegrams. Early and late I tested the telegraphic service and found it up to the mark.

It is, I believe, a regulation that all telegrams are to be prepaid by stamps; the said stamps in all cases to be affixed by the sender. The former of these provisions is no doubt invariably carried out, but as the latter is not always, I cannot speak positively as to either.

As a matter of fact, I was rarely required to affix my own stamps in telegraph offices in large cities; whereas the letter of the law was fully carried out at small places; the principle being, I suppose, at these places to make up in formality for what was lacking in amount of business.

The facilities for telegraphy in the United Kingdom are wonderfully complete, and I found no place too small for a telegraph office; moreover, in my opinion, telegraphy is there cheap, in spite of the fact that the address and signature has to be counted in and paid for.

The dynamo does not appear to be employed as a source of telegraphic currents, and here I think, the British telegraph system is a little behind the times. Yet, as far back as 1873, I understand that Mr. Preece experimented with the Gramme machine for this purpose, but found it too unsteady for the Wheatstone automatic instruments.

There are 23,000 cells of battery in use at the central station in London and 220 circuits are supplied by accumulators.

Do I approve of the telegraphs being owned by the Government? In a monarchy, whether limited or absolute, yes; because the Government is permanent and usually stable. It answers well in England—it is cheap and good. But does it pay? Well, if you consider that the agencies of a Government should be administered for the people's benefit, I think it does. But for a republic, at least one like ours, in which radical and sweeping changes of administration occur at frequent intervals, I am clearly of the impression that a Government ownership would be an unqualified evil. No doubt a Government control leads to a superabundance of red tape; to the ridiculously excessive formalities of the circumlocution office, and to extreme conservatism. It also acts as a damp sheet upon invention. Yet in spite of these tendencies, the telegraphs of the British Isles are, I think, on the whole better managed and better manned than they would be by one or more corporations, and the question of remunerativeness seems to me quite of a secondary character, since, even though the telegraph department be not profitable, it seems at least evident that the people are enjoying a lower rate than they would under other circumstances be entitled to or receive.

The rigid rule of discipline was, however, well illustrated in an attempt which I made to see the telegraph office at Birmingham, but where I was told that they would have to write to London for permission to allow my visit. I could not wait the exchange of correspondence, and thus have not, as yet, seen the telegraph office there. It seems the telegraph department does not use its wires at all on office business, but employs the mail altogether, the wires being reserved exclusively for paid business.

ELECTRIC LIGHTING.

From my point of sight as an electrical engineer, I was disappointed to find that electric street lighting was, comparatively speaking, still a thing of the future nearly all over the kingdom. Not that electric lighting is not being done, but that so little of what can be done, is seen. Instead of having electric illumination all around you, as we have it, we have, so to speak, to hunt up installations.

There are a number of central station plants in London, but London is an immensity, and might contain many more, and yet electric lighting would be conspicuous by its paucity. You may, for example, walk through Holborn and Oxford street and see lines of glorious shops lighted electrically; you may go to Grosvenor gallery and watch the historical illumination there; and you may, at various factories, see that the electric light is for this class of work being extensively employed.

The Great Western railway station at Paddington is lighted up by 100 arc lamps and an infinity of incandescent hairpins; and many seaside resorts know of the electric light; while at Glasgow and Liverpool are central lighting stations of high capacity, but, in spite of all this, you cannot help forming and bringing home the impression that there has been but little done in comparison with the immense amount which remains undone in this branch of electrical application. The truth is that the British public seems to have had a surfeit of electric lighting companies at any early date, with all that an electric lighting company implied in the years 1878 to 1882, and has of late years had no wish to take a second dose.

As a telephone electrician, I felt disposed to congratulate the telephone and telegraph people that they had escaped the horrors of burned out central stations and disturbed circuits.

Such lighting companies as may hereafter undertake to occupy this field are also to be congratulated that they will have the several years' experience of others, and all of the many improvements which have been produced in apparatus and insulation to profit by. I think that municipalities in England will themselves shortly take up this matter. In no case, I am sure, will "undertaker's wire," or the reckless class of construction which we have too often seen in this land of liberty, be tolerated.

Isolated house lighting is, however, well advanced. Inquiries which I made proved that this branch of incandescent electric lighting which has overflowed upon the steamships and boats is very popular. In the several examples of it, which came under my personal notice, the electricity is drawn from secondary batteries, which are during the day charged by a dynamo.

I had the happiness of dining with Mr. W. H. Preece at his house at Wimbledon, and of examining his lighting plant. He uses the secondary cells of the Electrical Power Storage Company. The plates are formed of a leaden grid, the perforations of the positive plate being filled originally with minium, while those of the negative plate are filled with litharge. The charging dynamo was run by a gas engine, and Mr. Preece informed me that it cost him exactly as much for gas as it did when he used the gas for illuminating purposes, while he had a much greater amount of light. I am bound to state that in my opinion the light was superb, being apparently softer and more equable than when operated directly from the dynamo.

While upon this subject, I may state that I also had the pleasure of inspecting the beautiful laboratory and workshop of Sir David Salomons at Broomhill, Tunbridge Wells. Sir David is a wealthy amateur who has made the realm of secondary batteries peculiarly his own; and who has written a text book on their construction and care, which, if not absolutely faultless, is certainly the most useful and practical work on the subject in existence. He has a pair of fine compound steam engines and several dynamos, these being connected with the prime motors, by leather link belts of American manufacture.

A great number of storage cells, several hundred I should judge, and in prime condition, are located in a side room floored with glazed tile; the entire floor sloping to one side for purposes of drainage. In the machine shop I saw some of the finest machine tools that my eyes have ever fallen upon, lathes, drills, planers, sharpers and so forth; and it was particularly noticeable that each machine was provided with its own electro-motor. All of the motors were of the Elwell-Parker make. Upon a shelf in the laboratory office were a few well chosen books, among which I noticed the last bound volume of the proceedings of this institute.

Sir David uses these motors for every conceivable purpose, furnishing electric light and power for his entire establishment; and while I was there, electricity was employed in making butter. If an electrician whose heart is in his work is ever justified in cherishing envy in his bosom, it is when visiting such a place as that of Sir David Salomons; and he has my heartiest acknowledgments for the kind way in which he allowed me to inspect the same, though himself absent. I saw throughout my travels little in the motor line, except those to which I have referred, but I am informed that the use of electro-motors in Britain is already great and is rapidly increasing.

TELEPHONY.

The chief centers of good work in telephony are Dundee, Glasgow, Liverpool, London, Edinburgh, Manchester and Birmingham. The fact that I mention Birmingham last shows that no attempt at classification has been made. I could not inspect the Liverpool central station, as I happened to be there only during holidays when the authorities were all absent: and for lack of time, I was unable to visit Manchester at all; but I saw a good deal of the Liverpool outside construction, and I heard enough about Manchester to assure myself that the installation was *par excellence*.

Many of you will be aware that three of the principal telephone companies in England, viz: the United, the National and the Lancashire and Cheshire, have recently joined their forces under the name of the National Telephone Company, limited.

This company has now taken charge of the London Exchange, where I was rather surprised to find that there were already more than 7,000 subscribers.

There, nearly all lines were built over the housetops, with tubular iron fixtures of a construction, beautiful and light, and yet strong. A very peculiar feature of this London construction was that the wires of a route were, as a rule, all strung to a vertical plane, there being very few cross arms. This made a very symmetrical appearance, but it struck me that it was hardly a sufficient utilization of a route, or as the Britons say, of the "way leave." This, however, was the work of the United Company, and, I think, was not in accordance with the judgment of the engineer of that company, who remains in the same capacity with its successor.

The post office department charges the telephone companies a regular royalty, it having been legally decided that the telephone is a "telegraph" within the meaning of the statute. The Postmaster General apparently does not like the action of the companies in uniting, although none of them were competitive, but all working in distinct territories. There is no doubt, however, that he fears that the capitalization will unnecessarily enlarge, and will be a big bite for the government mouth whenever, and if ever, purchase may be decided upon.

It does not seem to me likely that the Postmaster General will take any steps to harass the companies, nor do I believe that the post office telegraph department will care, for a long time to come, to trouble itself with telephony; and it is my opinion that the remaining telephone companies will soon in turn be absorbed or otherwise unite with the National Company.

Long line telephone work in Great Britain is, of course, limited by the size of the island and by the peculiar relative position of the large towns. I found very good talking between Birmingham and the several towns of Sheffield, Derby and Nottingham; between Glasgow and Edinburgh and Dundee; and especially fine from Sunderland to points upwards of 100 miles distant. For these latter distances, circuits had to be artificially made up. In London there are necessarily many central telephone stations. No one who has not seen and studied London can form an idea of its vastness; and by reason of this vastness there will always be (notwithstanding the manifest excellencies of centralization) a plurality of central stations connected by trunk lines, mainly converging to a principal trunk station; but supplemented by a sufficient number of trunks between such central stations as are adjacent to each other. Yet I should say that there are at present too many central stations and that they are too close together; and I am under the impression that the present management thinks so to, and will condense closely grouped central offices considerably.

In Scotland I found a regular multiple switchboard in the Glasgow central station which was the most American looking central station which I have seen anywhere. In Glasgow, also, a "nickel in the slot" toll box has been devised and is largely used at public stations, a penny or a certain number of pennies being the local charge, and a sixpence or more the trunk line or out of town charge. The operator can tell by peculiar sound signals automatically given by the passage of a coin or coins, whether the proper amount is dropped in; and if not the machine simply absorbs what has been put in and does not grant the desired accommodation. Regular subscribers have a check key which operates the apparatus without requiring the electro-deposition of a coin. This machine is well spoken of and is said to give satisfaction. In some other parts of England these boxes are also used, and non-subscribers to the exchange may purchase a local check key for the purpose of using at any time the public station without having to pay every time. It may be of interest to state that at every railway station in England the "nickel in the slot," or rather the "copper in the slot," machine applied to a variety of uses, is to be found. The weighing machine is the most popular, but the electrical shocking machine is a close second.

The best working long lines which I found were, without doubt, those belonging to the Northern District Telephone Company. This company is in charge of Mr. C. B. Clay, of Sunderland; the lines are new and are built of the latest model.

In Newcastle all lines, both telegraph and telephone, which are owned by the government are underground. They work very well, and the government telephone system there is ably managed by Mr. A. W. Heaviside, who based his telephone exchange upon a pre-telephone exchange, actually in existence in Newcastle and operating dial telegraphs, long before the telephone exchange was thought of, or the telephone itself invented.

The National Telephone Company is fortunate in having such men as Messrs. Bennett, Coleman, Jackson, Phillips, Sinclair, and, as far as possible, employs men trained by previous education and experience to be equally efficient in a business and technical capacity.

As to electrical construction outside, I may say, without hesitation, that the average is far above ours, whether telegraphic, telephonic or otherwise. The poles are no longer than are necessary, are uniformly well trimmed and painted and, above all, are well stayed. Mile after mile I have ridden on a railway both in England and on the Continent, and found *every* pole "stayed;" or, as we would say, "guyed." The cross arms are usually short, and project alternately a greater distance to one side or the other, that is, the upper cross arm may carry two insulators on the right side of the pole and but one on the left. While the next will reverse that, two being on the left and one on the right, and so on. The telephone companies had much housetop construction, but the same system of staying prevailed, so that the construction was superb, even though the roofs were all of the pitched variety. In Sunderland only, and the other towns where the Northern District Telephone Company holds sway, are to be found long cross arms *a la* American, the idea having been imported by Mr. Clay, who visited the United States a year or two ago, and who is a manager of the most progressive type.

In Edinburgh, though nearly all wires were overhead, they were so symmetrically arranged as to be hardly noticed. Mr. A. R. Bennett, who is general manager of the Edinburgh District, looks also after Dundee, Galashiels, Dumfries and many other towns.

The above remarks apply alike to the government construction in Great Britain, France and Belgium, and to the construction of telephone companies.

The only underground telephone line work which I found was the well-known Paris sewer work and the government telephone exchange wires at Newcastle-upon-Tyne, but the National Telephone Company is beginning to lay some underground wires in Birmingham.

At Birmingham, also, I noticed some little pole work, and it was both amusing and instructive to see that, wherever possible, the poles were modestly planted close to the gable end of a block of buildings, or inside of a high fence, or in the corner of a vacant lot, so as to attract as little notice as possible.

I found that silicious bronze wire was well thought of throughout the several territories which I visited, and in general use. It can be made of a conductivity nearly as high as copper, while it is tougher; and it is much better for telephone work than iron, because not only is the conductivity higher, but it possesses a much lower coefficient of self-induction.

One telephone span I saw in the south of England, crossing the opening of the Dartmouth harbor, which was certainly not less than half a mile in length. I venture the prophecy that in the near future we shall use silicious bronze here in the United States much more than heretofore we have done.

In France I visited, of course, the Exposition, and met Messrs. Abdank-Abakanowics and Berthon, both old friends. The finest electrical affair about the Exposition, to my mind, was the way in which the great fountain was illuminated in kaleidoscopic colors every night. This has, of course, often been done before, but never, I think, so perfectly or on such a scale. The success of the installation is due to Mr. Aylmer, who has had it in charge.

I stood in the tower and admired, and then I went down through the tunnels and stood beneath the fountain, where the arc lights were reflected through colored screens, and through the plate glass floor; and marvelled and admired still more; especially when I saw how the levers arranged in the tower like those of the Pennsylvania railway signal tower worked pneumatically the screen mechanism below, and kept an ever changing succession of beautiful colors upon the different fountain jets; and all this apparently, so far as the crowd could see, working itself; for there was no manifest link between the operating tower and the fountain.

The Exposition telephone station as arranged by Mr. L. Berthon was a sight in itself, with its multiple switchboard; its closets for private communication; its samples of fine electrical apparatus made by the Societe Generale des Telephones, and its apparatus and circuit arrangements for receiving operatic performances, and reissuing them for the delectation of numerous auditors.

Long telephone lines stretch from Paris to Havre, Lille, Bruxelles, Lyons and Marseilles, and work admirably. These are chiefly of copper and are arranged in metallic circuits.

Mr. Berthon, the managing engineer of the Societe Generale des Telephones, told me that his company while sparing no effort to keep up its efficiency, had for some little time been lying on its oars in view of the possible purchase of its telephonic property by the government. And as you are aware, the government has since decided to acquire this property; and has in fact taken possession of it, which action, I believe, to be an unfortunate one, alike for the government, the Societe and the people.

Of course the great Edison exhibit with its 9,000 feet of floor space was a tremendous affair, and, although it would naturally impress the observer without any extraneous aid, it is fair to say that its merits were literally hammered into the visitor's mind by the able enthusiast who had it in charge.

This, together with the surpassingly fine exhibit made by the Thomson-Houston Company in association with the Thomson Electric Welding Company, and also the unique historical exhibit made by the American Bell Telephone Company, fully redeemed the electrical section from any participancy in the otherwise too true charge that the share of America in the great Exposition was comparatively insignificant.

The compound engines, built by Messrs. Davey, Paxman & Company, of Colchester, England, to run the dynamo for lighting the fountain tower and exhibition, were an interesting sight to me. I was delighted to watch their fine and speedy regulation as the requirements varied. The young man who was running them was a rising electrician, Mr. H. D. Wilkinson, the same who succeeded Mr. Kennelly in the authorship of the series of electrical measurements, articles lately published by the London *Electrician*.

Mr. Wilkinson, believing it right to give himself a practical intimacy with all branches of electrical engineering, was taking this method of doing so, and illustrating the English tendency to carry out to the fullest extent the scriptural maxim, "Whatsoever thy hand findeth to do, do it with thy might."

I was favored by Messrs. Siemens Brothers & Company, by permission, to visit their works at Charlton, Woolwich. There I found active work going on in all branches of electrical manufacture, but the most new and interesting feature to me was the submarine cable work which I witnessed in various stages. This, I could not avoid reflecting, is the one branch of electrical work in which Britain is practically without competition. Here I met Mr. Frank Jacob, the electrician of the Siemens Company, a remarkably able and intelligent man, and the inventor of one of the earliest systems of multiple telephony and combined telephony and telegraphy. A most interesting feature of the Siemens' works is the testing room, where every foot of cable is tested during the process of manufacture. Immediately across the river, and thus an opposition physically as well as commercially, is the rival cable establishment of Silverton.

Speaking of manufacturies, brings to mind that the tendency of the British business public to consolidation (or amalgamation as it is mercurially termed) after having swept over all the breweries, distilleries and gas companies within reach and after having touched the telephone companies, is now exerting itself upon the electrical manufacturing interests; as evidenced by the fact that all of the storage battery companies and electric railway companies have amalgamated to form "The Electric Construction Corporation, Limited," and that the various Woodhouse and Rawson manufacturing companies have also consolidated into a large joint stock corporation.

While in Birmingham, and engaged in visiting the local lions, I went to see Aston Hall, the free museum of the town.

In one of the many interesting rooms there I observed on exhibition an old fashioned large magneto machine designed, as an inscription thereon informed me, for use in electro-plating. Upon close inspection, I found it to be the first magneto machine ever designed for that purpose; namely, that made and patented in 1842 by Stephen J. Woolrich. This machine was presented to the musem by Thomas Prime & Son, electro-metallurgists, of Birmingham.

Passing through the cathedrals and abbeys of Great Britain, my bosom, like that of Sir Joseph Porter, K.C.B., swelled with pride, to note how these building and their precincts were made into a species of mundane Valhalla, where the worthies of the nation, distinguished in war, science, or literature were immortalized, and their memories treasured, for the example and encouragement of their countrymen, and as a mark of appreciative acknowledgment of their services rendered to their country.

In Westminster Abbey I remarked the tombstone of William Spottiswoode, electrician and philosopher, while in the abbey and churchyard of Melrose I noticed respectively the graves of Michael Scott and Sir David Brewster, one the friend of True Thomas, the Rhymer, of Ercildown, and the scientist par excellence of the fourteenth century; the other one of the more fortunate wizards of the nineteenth century. Michael in his day was called a "wizard," but would probably now be called an electrician.

In conclusion, I desire to say that the cordial and fraternal manner in which everywhere I was received by electricians and by those interested in electrical development, and the hearty hospitality which I received, merit and receive on my part the profoundest appreciation and the warmest reciprocal feelings of kindliness.

That Halifax-Bermuda Cable.

For years there has been talk at Halifax and at the Bermudas about a cable which was at some time, it was hoped, to be laid between Nova Scotia's capital and the islands in question. A meeting of the company which is to lay this cable was held at Winchester House, Old Broad street, London, on the 21st September. Sir Alexander Armstrong presided. From the report submitted it appeared that the company had been incorporated for the purposes of carrying out a contract with Her Majesty's Government for laying a telegraphic cable between Halifax (Nova Scotia) and the Bermudas. The Government had agreed to provide a subsidy of £8,100 a year for 20 years on certain conditions. In dealing with the report the chairman said that the company's arrangements with the Government had been concluded in a very satisfactory manner. Throughout the various negotiations with the Government they had received very fair treatment. The cable work was now progressing as rapidly as possible, and they looked forward hopefully to its being concluded at an early period. The directors expected a very extensive traffic from Bermuda, because its climate in winter was remarkably fine, and it had hitherto been a very popular resort of American visitors. The establishment of direct communication with the mainland would enable business men to visit the island and conduct their business at the same time.

Awarded the Grand Prize.

The Babcock & Wilcox Company have received the *Grand Prix* at the Paris Exposition, the highest award given to any exhibitor. This award was not cabled with the other American awards, as the boilers taking the prize were made in the company's Glasgow shops, and were therefore placed in in the British section and the award made to the company as English exhibitors. The jury was one of high character, which makes the acknowledgment all the more welcome to this long established American company. We think it can be safely said that this company has built up its business upon the merit of its work, taking the stand that a steam boiler can be neither too good or too safe. This boiler is favorably known and in use in every country on the globe.

RAILWAY TELEGRAPHY.

The Superintendents Meet in Washington—Large Increase in Membership—A Very Successful Meeting.

INTERESTING AND PRACTICAL PAPER BY MR. CHAS. SELDEN ON "ELECTRIC TRAIN LIGHTING"—DISCUSSIONS, EXHIBITS, VISIT TO THE WEITE HOUSE, PERSONALS, ETC.

The Association of Railway Telegraph Superintendents opened its eight annual Convention at 10 A. M., Oct. 16, in the Ebbitt. President Geo. C. Kinsman, of the Wabash Road, called the meeting to order, and briefly and clearly outlined the business to be transacted. The following officers and delegates were in attendance:

Geo. C. Kinsman, Wabash Road, president, Decatur, Ill.; C. A. Darlton, R. & D., vice-president, Washington, D. C.; P. W. Drew, C. & E. I., secretary and treasurer, Chicago; W. W. Nichols, C., B. & Q., Chicago; U. J. Fry, C., M. & St. P., Milwaukee; H. F. Houghton, Wabash, Decatur, Ill.; M. A. Baker, St. L., K. & N. W., Hannibal, Mo.; A. R. Lingafelt, C., R. I. & P., Topeka, Kans.; J. L. Orbison, C., H. & D., Cincinnati; S. K. Bullard, M., K. & T., Sedalia, Mo.; Geo. T. Williams, N. Y., C. & St. L., Cleveland, Ohio; Robert Stewart, C. R. R. of N. J., Elizabeth, N. J.; W. J. Holmes, N. Y., L. E. & W., New York; L. B. Foley, D., L. & W., New York; W. F. Taylor, Pa. R. R., Altoona, Pa.; Geo. L. Lang, N. Y. & N. E., Boston; J. N. Ross, N. Y. & N. E., Boston; C. Selden, B. & O., Baltimore; I. T. Dyer, H. & St. Jo., St. Joseph, Mo.; C. N. Chevalier, N. Y. & N. E., Providence, R. I.; H. C. Sprague, K. C., Ft. S. & G., Kansas City, Mo.; J. B. Shaw, N. Y., P. & O., Jamestown, N. Y.; W. C. Walstrum, N. & W., Roanoke, Va.; M. B. Leonard, C. & O., Richmond, Va.

New members were elected as follows:

H. V. Miller, C. & A., Bloomington, Ill.; U. J. Fry, C. & St. P., Milwaukee; W. W. Nichols, C., B. & Q., Chicago; F. W. Dow, N. L. N., New London, Conn.; I. T. Dyer, H. & St. Jo., St. Joseph, Mo.; D. E. L. Cannon, St. L., A. & T., Texarkana, Tex.; S. K. Bullard, M. K. & T., Sedalia, Mo., A. K. Cheney, St. L., B. & T., St. Louis, Mo.; N. S. Martin, L. & N., Birmingham, Ala.; C. F. Wilcox, Wabash, Decatur, Ill.; J. W. Stacey, Mo. Pac., Marshall, Tex.; W. B. Scott, C., St. P. & K. C., St. Paul, Minn.; M. A. Baker, St. L., K. & N. W., Hannibal, Mo.; W. C. Walstrum, N. & W. Ry., Roanoke, Va.; A. Ramseur, Piedmont Air Line, Atlanta, Ga.; C. A. Smith, L. I. & I. R. R., Kankakee, Ill.; W. J. Quinlan, G. R. & I., Grand Rapids, Mich.; A. R. Lingafelt, C., R. I. & P., Topeka, Kas.; N. McKinnon, Tol., St. L. & K. C., Toledo, O.; D. H. Caldwell, N. Y. C. & St. L., Ft. Wayne, Ind.; J. L. Orbison, C., H. & D., Cincinnati, O.; R. W. Mitchener, N. Y. C. & St. L., Conneaut, O.; W. F. Taylor, Penn. R. R., Altoona, Pa.; W. E. Lewis, L. I. R. R., Long Island City, N. Y.; J. J. Burns, D. & R. G., Denver, Col.; J. B. Stewart, West Shore, Weehawken, N. J.; E. E. Dinwiddie, R. & D., Charleston, W. Va.

This list includes the names of representatives of very large and important railroad systems, like the Pennsylvania, C., H. & D., M., K. & T. and the St. L., Ark. & Tex., which have not heretofore been represented, and indicates the rapid growth of the organization and the extension of its influence and field of usefulness.

The report of Treasurer Drew, who is also the secretary of the Association, showed efficient and economical management and a prosperous condition of the finances.

The committee appointed at the last meeting to prepare papers and subjects for discussion, not being ready to report, the Convention decided, on motion of Mr. Geo. T. Williams, to adjourn until ten o'clock tomorrow, and the members, many of whom were accompanied by their wives, spent the afternoon in visiting places of interest about the city under the guidance and advice of Vice-president Darlton, of this city, who, with superintendent Selden of the B. & O., at Baltimore, has had charge of all local arrangements for the meeting.

THURSDAY, OCTOBER 17TH.

The Convention met at 10 A. M. Reports of standing committees being called for by the chairman, Mr. Leonard, chairman of the committee on electrical information, reported that papers received by his committee had already been published. He presumed that it had not been generally understood by the members that information was to be sent to the committee, and that various questions of interest would be communicated direct to the meeting during its sessions.

The election of officers for the ensuing year was then held and the following gentlemen were chosen by unanimous votes:

President, C. A. Darlton, of Washington, D. C.

Vice-president, Geo. T. Williams, of Cleveland, Ohio.

Secretary and treasurer, P. W. Drew, of Chicago, Ill. This will be Mr. Drew's seventh year of continuous service as secretary and treasurer.

After the election Mr. Kinsman escorted the new president to the chair, and subsequent proceedings were conducted by him.

Miscellaneous business being in order, Mr. Lang called attention to the fact that members occasionally discontinued their connection with the Association on account of promotions in their companies, and expressed the opinion that it was hardly just to expect division operators or superintendents to decline appointment as general manager in order to maintain their membership while, at the same time, the Association could not afford to lose the benefit of their counsel and corporation. Mr. Kinsman strongly endorsed Mr. Lang's statement, and suggested that such persons be elected to honorary membership without dues. Mr. Williams thought honorary members might prefer to pay dues and considerable discussion ensued, during which the decision of the chairman, that persons once elected continued members so long as they paid their dues, seem to meet general approval and it was concluded best to establish no general rule on the subject. The following named gentlemen were then elected as honorary members: E. M. Herr, Geo. E. Simpson, W. K. Morley, J. N. Ross, S. K. Blair, S. S. Bogart.

A committee consisting of Williams, Shaw and Leonard, was appointed to recommend the time and place of the next meeting.

The secretary presented communications from Day K. Smith, of Kansas City, stating that the United States Military Telegraph Society and the Old-Timers would meet in Kansas City next September, and suggesting the advantage of having the Railway meeting at the same time; from A. R. Swift, regretting his inability to be present, and recommending that the next meeting be held early in the season, and *not* at Chicago; from Manager Morell Marean, of the Western Union office, offering free use of his company's lines to the members of the Association; and one from the White House, inviting the delegates, with the ladies, to call on the President at one o'clock.

Mr. Selden then read the following paper:

"ELECTRIC TRAIN LIGHTING"—BY CHARLES SELDEN.

Some months since your committee on papers to be read at this meeting assigned to me the subject of "Train Electric Lighting," since which time I have been availing myself of every opportunity, when coming into contact with either system in use, or parties exploiting them, to glean all the information possible, and I have, therefore, put myself in the way of meeting a number of electrical people.

I have found it a much greater task than I had expected, not only on account of the systems involved, but particularly on account of the claims of the various parties in regard to the system in which they were interested, and especially in dynamo schemes, one of which are so numerous.

The storage battery companies give the impression, in their circular, that it is their system which is being used upon the Pullman limited trains of the Pennsylvania Railroad Company, and their agent stated to me at their principal office that their battery, in connection with the "Barrett System," was being used entirely by the Pullman Company, and that the Pennsylvania Railroad Company was using their storage batteries, to the exclusion of all others. Upon investigation, however, I found that the Pennsylvania Railroad Company is using some of the "Julien" cells, but a majority of their cells are from the New York Accumulator Company, and upon investigation with the Pullman Company I found that they are *not* using the "Barrett System," and that while they are using a number of "Julien" cells, it is also true that they are using a number of the Accumulator Company's cells.

Whenever I attempted to get down to figures with any of these exploiters or promoters, I was always met with a general answer which was of no use whatever to us in contemplating the introduction of such a system upon our roads. By travelling first and carefully noting the devices employed and then conferring with manufacturers, I became conversant with what ordinarily would be the worst of such things as were in sight, and I am now able to offer you, for probably the first time that it has been done, the *maximum figures* upon at least one system (this is the system employed by the Pullman Company and which I designate below as System No. 1), and from this we can deduce the cost of one other (System No. 2).

I made several trips on their trains and observed the working of this system in all its particulars, spending the better part of three nights run in watching, both in the baggage car as well as others, and it was very satisfactory indeed, the light being brilliant and everything that could be desired.

On a recent trip to Chicago I called upon the chief electrician of the Pullman Company, who very kindly accompanied me to Pullman, showed me through their plant and gave me valuable information. There are some points in this system, however, which were not explained to me, for the reason that there are pending patents; but this *does not enter into the matter of cost*, and I was told that it was only in protection to their company that many matters were not at this time made public.

I have examined the Boston and Albany system partially, but as that is purely storage battery affair, I cannot report results in figures until facts are obtainable upon which I can stand and feel assured that the figures which I give will at least not represent a cost less than we would find if put into practice; the figures I herewith give you are therefore *maximum*.

In practice this subject can well be considered under the head of three systems.

1.—Lighting cars by the joint use of dynamo and storage battery.

2.—Lighting cars by means of direct current from the dynamo.

3.—Lighting cars by means of charged storage battery.

System No. 1 is in use by the Pullman Palace Car Company upon its limited New York and Chicago trains, the vestibuled trains of the Atchison, Topeka and Santa Fe Railroad Company and others.

To explain System No. 1 (and it has more or less bearing upon all of the systems), I think it best to commence upon the car.

WIRING.

By experience it has been deemed best to place the wire on top of the cars. For this purpose there is a moulding run along from end to end upon the roof of the car, and branch mouldings extend to points over the panels between the ventilators of the car. The latter arrangement is used for day, smoking or other coaches, where it is desirable to have the lamps suspended from the bracket on the side of the car, instead of forming part of the lamp fixture which is in the center. The main wires or leads are covered in this moulding along the top of the car and branches therefrom are either dropped down through the air tube of the ordinary lamp (where center suspension is desired) or led through the panel noted above, where it is desirable to have a bracket. On top of this moulding is placed another, and then all of this moulding is tinned over and securely soldered so that there is no leakage into the car and the wires are fully protected. They are also free, in a great measure, from any movement by reason of oscillation or jarring, and hence the chances for abrasion of the insulation are reduced to a minimum, while at the same time they can be gotten at much more easily than though they were placed between the roof and the head-lining.

While it is true that the wiring of a sleeper (on account of the greater number of lights employed) is greater than that of a day coach, the average cost per car, fitted with the best wire, is about $100. This includes labor. The next subject in order would be

ENGINE AND DYNAMO.

A "Brotherhood" engine directly connected with an "Eickemeyer" dynamo, both of them being upon the same cast-iron bedplate, is placed within a lattice-work enclosure at the forward end of the baggage car, occupying a corner between the end-door and the side-door. Ordinarily this space is 3½x5½ feet. This engine is fed by steam from the locomotive, the steam-gauge within the baggage car usually showing a pressure of 60 pounds, of which 15 is exhausted through the pipe for heating the train. The dynamo has an electro-motive force of 68 and has 60 amperes at 800 revolutions per minute. It should be understood that at 900 revolutions the same machine would give you 80 volts and 80 amperes. A good dynamo of this capacity will give plenty of light for 120 lamps throughout the train, and is considered an economical one for the reason that it has margin enough to serve a longer train than usually carried, so as to meet emergencies, should they arise. The Eickemeyer dynamo, while first class in all respects, is especially so for train service. The lattice-work has a door and is also open at the dynamo end so as to admit of placing a tachometer belt upon it, and arranging for the adjustment of brushes, should it become necessary, but upon the runs I made it was not necessary to adjust the brushes, and there was no sparking at the brushes, even under full load—a most desirable point in favor of this type of machine.

Both the engine and the dynamo are fed by an automatic lubricator, which is placed against the side end of the car, and carries sufficient oil for one or two round trips, and having small service pipes extending to the oil cups, feeding them regularly, without the attention of an engineer, other than to see that they are properly started at the beginning of the run.

Against the side of the car is placed a steam-gauge, showing the pressure received from the engine, another steam-gauge showing the amount of steam going into the heating pipe through exhaust, an ammeter, a voltmeter, a test lamp and a tachometer, the practical use of which will be shown latter on.

There is a connection device for connecting the cars together, so arranged that should they part it will be released as is now the case with the air brake pipe. I have thus been full in the explanation regarding the baggage car, because it is, of course, the key to the whole situation. This brings us to the

STORAGE BATTERY.

Each car carries in a box, securely fastened to the bottom of the car, 32 cells of storage battery, and under the system of distribution this storage battery is partly in use at all times, furnishing when the dynamo is running 30 per cent. of the power given to the lamps, and when the dynamo is not running furnishing all the power. Thirty-two cells are used for the reason that the lamps used in this system are all of a high voltage, namely, 63, the weight complete of the battery and its boxes being 1,300 pounds per car.

During the day or at other times when the lights are not in use, the dynamo is run a number of hours charging these storage batteries, so it is unnecessary to remove them from their location under the cars for a long term, dependent, ordinarily, upon whether or not they have been in a wreck, or by long use the plates have become buckled, when, of course, it is necessary to remove such plates and put the battery in good condition.

It is claimed that with this system the storage batteries last longer than where they are subject to removal for recharging at the end of each trip. Whether this is true or not is a question which experience alone would determine, but I am inclined to the opinion that the statement is correct.

ATTENDANT.

This system, as in vogue, has an attendant ($90 per month and board while on the train), who is more or less experienced in electric lighting, and at terminal stations, that is to say, Chicago and New York, an expert ordinarily inspects the condition of the electric service prior to the train leaving, and at the station at Pullman they have also an electric light plant, which is utilized for storing electricity for their cars placed in the shop and which are about to start out on the road.

GENERALLY.

The above will, I think, give you a clear idea of the general method employed.

The arrangement of the engine is so concise that I do not see why the baggage master should not be able to run it, after a little coaching, without any other attendant. For instance, if we have a gauge for steam from the engine with a notice under it that "This gauge should stand 65," and under the ammeter, "This gauge should stand at 63," and under the tachometer, "This gauge should stand at 800," it seems to me that any one with the least bit of common sense and a little bit of drilling would surely be able to run the plant, for (as can be explained to him) if with cock fully open steam should get below the point which you mark and call his attention to, he is to call on the engineer for more steam. If the revolutions should fall below 800 it would at once call his attention to the steam gauge, and if the voltmeter or the ammeter should show out of proportion, the test lamp in the baggage car or the other lamps in the baggage car would become dim, thus calling his attention even though he were otherwise engaged. If the engine men cannot give him more steam, there is but one thing for him to do, namely: Cut off the dynamo entirely and fall back upon the storage battery for the light for the train. This, I think, would complete all I have to say at present upon System No. 1, the expense of which I show in full later on in this paper.

SYSTEM NO. 2.

The system of lighting direct from a dynamo upon a train, without the auxiliary

help of a storage battery, is not in use, but I confess that I do not see why it would not be a good thing to do and save the expense both in plant and the depreciation of the storage battery. There is an objection, of course, that in case of any failure, either in connections, engine or dynamo, the lights would go out, leaving the train in darkness. This, however, could be obviated, I think, by keeping one coach candle in each car lit, or one lamp in each car lit; it is necessary to carry lamps or candles anyhow for emergencies. It is also necessary when the steam heat fails to employ as before the Baker or other heater for your cars, so that whether your lamps are lit or not, as a matter of fact there are many times when you have oil in your cars and you have fire in them.

The efficiency of dynamos in this day, and especially the one noted, is such that I do not think there will be a failure on account of either the dynamo or the engine amounting to one per cent. of the time of its use, while should a derailment occur, I cannot but believe that the storage battery will be just as apt to be rendered useless by breakas well as would the other mechanism.

SYSTEM NO. 3.

System No. 3 is employed by the Pennsylvania Railroad Company, the Boston and Albany, and some others. I have been unable, as yet, to get any figures as to the cost. This system consists in merely placing upon each car a number of cells of storage battery (the cost of each cell ranging from $9.00 to $12.00) which are usually charged at the terminal points, the batteries then being trucked to the cars and placed therein, running one trip and then being trucked out for recharge.

The Pennsylvania Company uses a small number of cells (12 to the car), and a low voltage lamp, namely, 23 volts. They claim to get 16 candle-power to each lamp, but I hardly think they do this. The lamps that I have seen seem to me to be of less candle-power, and they seem to use a smaller number than are necessary to properly light the car for reading. Ordinarily they carry seven lights in the body of the car of 23 volts, one in the smoking room of 22, and one in each hallway or approach of 24 volts, making in all 10 lights to the car. With the Pennsylvania Company, at the time of my examination, these lights were employed only in their parlor cars. The best report I could get from that company was to the effect that they really do not know what the lights cost them, that it had never been figured down in a fine way. They have power and electric light stations at Jersey City, and they use a portion of that power for storing currents during the day time, while at the same time the same power was employed at night in lighting their yards, etc., etc., so that it was a hard matter to get at, but they had determined that while the light was a little more expensive than oil, at the same time it was cheaper than gas as used formerly, which was placed in retorts underneath the car.

What I here say as to the cost of this system (*i.e.*, lack of absolute knowledge) is true of all roads using it so far as I could learn from those questioned.

OBSERVATIONS AND REMARKS.

Referring to the figures that follow, the prices of engines and dynamos can be shaded, while the depreciation noted may, in some instances, be greater than is shown, or in others less, still I give, from the best authority, the consensus of their opinion. Of course, the figures given do not include the cost of steam which runs the engine in the baggage car, but on that subject it was reported to me as follows: The officer of the Pennsylvania Railroad Company who has such matters in charge, states that the difference in the consumption of coal upon their locomotives (and this, of course, is the proper source from which I figure) is so slight as between those that are feeding dynamo engines and those that are not doing so, as to make no difference practically, and it has not affected the premiums which are given to firemen upon their saving of coal. It seems to me an easy figure, and a good average one, to get at it in this way. All things being proper we get ten 16 candle-power lights per horse-power; therefore, if you are running 100 lights you are using ten horse-power. I find a difference in the opinion of the engine men upon these trains, some saying that they do not notice, particularly, the loss of steam used by the dynamo engine, or in heating the train, others again complaining that they always feel it.

In order that you might have a basis upon which to figure to light each particular train, I have deemed it best to divide the cars into classes, namely: Baggage car equipped, mail coach, day coach, sleeper, dining car. It is necessary to run the baggage car next to the engine in order to get as short connection as possible for steam. By taking the figures which I give, you will be able to tell just about what it will cost in the way of plant for each of these cars, subject, however, to a reduction where the engine or dynamo or other fixtures can be purchased for a less sum than herein named, and it is quite possible, for instance in the matter of electric light arms and shade holders, that they could be made at railroad shops cheaper than they could be bought.

I enclose a statement of each car, which shows the number of the articles used, cost of each, total cost, per cent. depreciation, total depreciation and interest at five per cent. upon the plant.

In computing the interest upon the lamps I have placed it upon the *depreciation*, rather than upon the first cost, for the reason that *renewals* are necessary during the year; however, the same amount is not invested the whole year, of course, as the first lamps will run a certain time and so upon the last renewal there would only be interest for any one or two months, but for our purpose I deemed best to show it at the maximum, and I think it will just about cover the breakage, that is to say, where the lamps are broken but not burned out.

Following is the cost per car for *each class* of car equipped with System No. 1 Eickemeyer dynamo and Brotherhood engine, including depreciation and interest on plant at five per cent., *not* including salary of attendant:

In conclusion, I think I have placed before you the details in such shape as to admit of easy figuring for any kind of a train.

System No. 2 would be as much cheaper than System No. 1, as the cost of battery and its depreciation would amount to.

Either system (1 or 2), without an attendant, becomes still cheaper.

Should you deem best to recommend the lighting of trains, now that you have what I believe to be figures beyond which the cost will not go, I shall be glad to furnish any further information possible for me to obtain.

The reading of the paper was listened to with deep interest and, at its conclusion, Mr. Kinsman inquired whether Mr. Selden had calculated for damages to lighting apparatus from accidents, and the latter replied that the possible loss from such causes was included in the estimated item of depreciation. The question of placing train lighting plants in charge of baggage men, as recommended by Selden, elicited considerable discussion, Mr. Nichols and Mr. Leonard expressing very decided opinions that, even with all the automatic and self-regulating machinery in use, it would not be possible to get satisfactory results without the care of some skilled person to keep the apparatus in order, make necessary repairs, etc. The experience of those gentlemen had convinced them that the services of an expert were frequently called for and that they were liable to be needed just when the baggage men could not leave their regular work.

Mr. Nichols stated that the C., B. & Q Road had tried the experiment of lighting a few coaches with accumulators, and found that the expenses so far exceeded the cost of lighting with oil lamps that they had decided to stick to kerosene for awhile.

Reference being made to the plan of lighting trains from dynamos driven by gearing attached to the axles of the cars, Mr. Leonard said he understood this plan had been in successful operation on several important roads in England for a number of years and that the cost of power obtained in this way is very small, inasmuch as the connection with the axle is made only when there is power to spare. Mr. Lang had heard the statement, for which he could not vouch, that the Connecticut River R. R. had made extensive experiments in lighting trains in this manner with success and economy. They charge accumulators by a dynamo which is always disconnected from the axle when the train is starting or running up grade and, being connected when going down grade, utilizes power which would otherwise be wasted and also aids the brakes in stopping the train.

Mr. Williams' committee reported in favor of holding the next meeting either at St. Louis on the third Wednesday in May, or at Buffalo or Chicago on the third Wednesday in July. St. Louis found no admirers in the meeting; July in Buffalo was deemed too hot and too busy, and, upon the suggestion of Mr. Foley, it was finally decided to go to Niagara Falls on the third Wednesday in June, and, by direction of the meeting, President Darlton appointed as a committee of arrangements for that occasion, Messrs. J. B. Shaw, L. B. Foley, Geo. T. Williams, J. W. Fortune and J. W. Lattig.

The committee to select subjects for discussion was continued, with Mr. Nichols as chairman, in place of Mr. Herr. Some of the subjects suggested, besides those called up at this meeting, were:

Telephones.
Electric Lights for Yards.
Electric Lights at Wrecks.
Switchboards.
Block Systems.
Line Construction and Batteries.

At 12.30 P.M. the meeting took a recess till 3.30, and proceeded in a body to the White House, where the private rooms, as well as the East room, were opened for the reception, and the President greeted each person with great cordiality, apparently feeling much relieved and cheered by the fact that, unlike the members of most visiting delegations, every man in this party had favors to give and none to ask. Among the members, standing in a semi-circle near President Harrison and Mr. Drew while the latter made a 60 minute speech of presentation in 60 seconds, there were many exclamations of surprise at the remarkable similarity in appearance of the two men—size, figure, features, gestures, exactly alike—the only difference being that Drew was a little the better looking. After the reception the company was photographed in a group on the north portico of the new War Department building. An interesting bit of association will go with this picture, for the reason that these Railway Telegraphists stood on the exact spot from which went out the most important and exciting railroad and telegraph orders ever issued. At this place stood the gray columns of the *old* War Department, above which was the historic and tragic telegraph office of the "war time," opened when Thomas A. Scott came down from the Pennsylvania Central with Billy Wilson, Homer Bates and two or three other operators, and closed when Secretary Stanton held little Billy Kettles out of the window, and announced him to the shouting

BAGGAGE CAR.

ARTICLES REQUIRED.	No.	Cost Each.	TOTAL.	Per Cent. Depreciation.	TOTAL.	Interest, 5 Per Cent.
Engines	1	$650 00	$650 00	10	$65 00	$32 50
Dynamos	1	550 00	550 00	3	16 50	27 50
Battery Cells	32	9 00	288 00	16½	47 52	14 40
Connections	1	20 00	20 00			1 00
Wiring	1	100 00	100 00			5 00
Piping, steam gauge, lattice work, lubricator, and tachometer	1	128 00	128 00			6 40
Voltmeters	1	42 50	42 50			2 13
Ammeters	1	32 50	32 50			1 63
Safety-switches	1	20 00	20 00			1 00
Lamps	5	75	3 75	700	26 95	1 35
Lamp-sockets	5	1 10	5 50	1	06	28
Total			$1,840 25		$156 03	$93 19

MAIL COACH.

ARTICLES REQUIRED	No.	Cost Each.	TOTAL.	Per Cent. Depreciation.	TOTAL.	Interest, 5 Per Cent.
Battery Cells	32	$9 00	$288 00	16½	$47 52	$14 40
Wiring	1	100 00	100 00			5 00
Lamps	8	75	6 00	700	42 00	2 10
Lamp-sockets	8	1 10	8 80	1	09	44
Cut-outs	1	45	45			02
Switches	1	4 00	4 00			20
Connections	1	20 00	20 00			1 00
Total			$427 25		$89 61	$23 16

DAY COACH.

ARTICLES REQUIRED	No.	Cost Each.	TOTAL.	Per Cent. Depreciation.	TOTAL.	Interest, 5 Per Cent.
Battery Cells	32	$9 00	$288 00	16½	$47 52	$14 40
Wiring	1	100 00	100 00			5 00
Lamps	14	75	10 50	700	73 50	3 68
Lamp-sockets	14	1 10	15 40	1	15	77
Cut-outs	1	45	45			02
Switches	1	4 00	4 00			20
Connections	1	20 00	20 00			1 00
Shade-holders	14	18	2 52			13
Shades	14	35	4 90	10	49	25
Electric Light Arms	14	1 15	16 10			81
Total			$461 87		$121 66	$26 26

SLEEPER.

ARTICLES REQUIRED.	No.	Cost Each.	TOTAL.	Per Cent. Depreciation.	TOTAL.	Interest, 5 Per Cent.
Battery cells	32	$9 00	$288 00	16½	$47 52	$14 40
Wiring	1	100 00	100 00			5 00
Lamps	26	75	19 50	700	135 50	6 83
Lamp-sockets	26	1 10	28 60	1	29	1 43
Cut-outs	1	45	45		02	20
Switches	1	4 00	4 00			20
Connections	1	20 00	20 00			1 00
Shade-holders	26	18	4 68			23
Shades	26	35	9 10	10	91	46
Electric Light Arms	26	1 15	29 90			1 50
Total			$504 23		$185 22	$31 07

DINING CAR.

ARTICLES REQUIRED.	No.	Cost Each.	TOTAL.	Per Cent. Depreciation.	TOTAL.	Interest, 5 Per Cent.
Battery Cells	32	$9 00	$288 00	16½	$47 52	$14 40
Wiring	1	100 00	100 00			5 00
Lamps	21	75	15 75	700	110 25	5 52
Lamp-sockets	21	1 10	23 10	1	23	1 16
Cut-outs	1	45	45			02
Switches	1	4 00	4 00			20
Connections	1	20 00	20 00			1 00
Shade-holders	21	18	3 78			19
Shades	21	35	7 35	10	74	37
Electric Light Arms	21	1 15	24 15			1 21
Total			$486 58		$158 74	$29 06

Upon the above basis a train, as follows, would cost for 365 days of ten hours each—System No. 1:

CAR.	LAMPS.	DEPRECIATION.	INTEREST.
Baggage	$5	$156 03	$93 19
Smoker (or day)	14	121 66	28 26
Day	14	121 66	28 26
Sleeper	26	185 22	31 07
Sleeper	26	185 22	31 07
Total	$85	$709 79	$207 85

Or total as to equipment	$977 64
Add attendant at $90.00 per month	1,080 00
Total	$2,057 64
Or per day	$5 64
Per lamp, per day	06
Per lamp, per hour	006
Or for a baggage car, per day	32
For a day car, per day	92
For a sleeper, per day	1 72

throngs as the operator who had just received the good tidings that peace had come.

The meeting went promptly to work after recess, first considering the subject of "Discharges," and the necessity of reporting the same. An informal discussion showed that no uniformity in reporting discharges prevails, and that there is much difference of opinion as to the best course to be pursued. Some of the roads give a service card to every operator leaving its employ, and never engage one without a card, while others rely on the printed lists. Several members stated that at times the printed lists were received too late to be of any use, or failed to come altogether. This difficulty, the secretary explained, was owing to periodic lack of funds. Upon motion of Mr. Selden it was voted that all employés leaving the service be furnished with service cards, and that the secretary issue the list monthly and make assessments on all roads in the association sufficient to meet the expense. It was expressly declared that the publication of the name of a discharged operator did not necessarily affect his re-employment.

"Ciphers—is it advisable to use them to shorten correspondence?"—Mr. Selden reported that, after a year's labor, he had prepared a cipher containing 9,000 words and phrases, and had printed 1,000 copies at a cost of 50 cents each. It is extensively used in the business of the B. & O. road: messages are transmitted without repetition and with very few errors, and its use has proved very advantageous, both in reducing the amount of matter transmitted and in affording secrecy in communication whenever necessary.

"Night messages—is it advisable to hold unimportant business till night?"—Darlton's and Leonard's companies have adopted a plan by which the heads of departments appropriately stamp such messages as can properly be held till night, and this has resulted in a great saving of valuable time without any detriment to the business. Mr. Selden's company has also tried a similar plan with success.

"Induction Telegraphy."—Mr. Taylor, some time since, investigated the workings of the system in use on the Lehigh Valley Road. He considers it a thing of extreme novelty, but the Penna. Co. concluded that there was no place on its roads where the system could be used to advantage. Mr. Taylor does not believe it likely to be of any general use. It was understood that the L. V. Road has discontinued its use on all passenger trains. Much regret was expressed at the absence of Mr. Lattig who is considered the best posted man on this subject.

"The Phonoplex."—Mr. Taylor reported that the Penna. Co. has five circuits in regular operation—the longest being 117 miles with three offices—and is getting satisfactory service at very much less than the cost of additional lines for the same service would have been. The electrophone battery now employed requires renewal twice a week and its maintenance is somewhat difficult, but he has some plan, not explained, by which he hopes soon to obviate this trouble.

"Delany's Line Adjuster."—Mr. Lang has one circuit, 115 miles long, on the New York & New England Road, equipped with these instruments which have enabled him to work successfully through bad weather when the line would have been useless without them. He expects valuable things. The adjuster makes the line work a trifle heavy when there is no escape on it and they are disconnected when not needed.

This subject closed the discussions on regular topics, and after the appointment of Messrs. Holmes, Lang and Nichols, as a Committee on Exhibits at Niagara Falls, and the passage of resolutions of thanks to the retiring officers, Mr. Selden and the Western Union Telegraph Company, the meeting, at 5.30 P. M., adjourned.

EXHIBITS.

Edison's phonoplex, working beautifully on a line to Baltimore, under the supervision of W. S. Logue.

Delany's line adjuster, in practical operation, was examined with much interest. Some persons had an idea that the invention was to *adjust the relays* on an unsteady line, but it really keeps the current adjusted to the relays by a simple device, which, when any key is opened, entirely cuts off the batteries at both ends of the line. The small cost of the system—$75 down and $20 per year for each circuit, without regard to length or number of offices—makes it liable to general adoption. Mr. Delany, who was in attendance, also exhibited an improved gravity battery, the improvements consisting in placing a paper bag around the zinc, enclosing the charge of blue vitriol in a pasteboard box with the copper band bent around it, and a narrow band of rubber pasted around the inside of the cell to prevent the sulphate of zinc from creeping over the top. The advantages of this arrangement are apparent.

J. H. Bunnell & Co., represented by Geo. S. Kates, exhibited a fine collection of telegraph instruments, testing apparatus, engine house annunciators and other articles of special interest to railway electricians.

The Western Electric Co. sent, through their agents, Royce and Marean, a large display of registers and miscellaneous goods of their manufacture.

The Pennsylvania Steel Co. had on exhibition a very ingenious system of alarm signals for highway crossings, operated entirely by magnetic generators, and a system of electric semaphone signals, containing some new and valuable features.

This exhibit was under the direction of Geo. W. Parsons, superintendent, and M. W. Long, the inventor, who gave full explanations to all callers.

Many of the delegates went to see La Dow's Morse writer, in the N. Y. *Tribune* office. Mr. La Dow is working out a plan for making a single depression of a key in a Remington typewriter transmit a Morse letter over a line, the object being to increase the speed of transmission up to the capacity of receiving operator to copy the message on a typewriter.

PERSONAL.

The innate propensity of a Morse operator to lean up against the wall of a country railroad station as near the window of the telegraph office as he can get, especially if the office is decorated with lace curtains, bird cages and geraniums, brought quite a number of old telegraphers to the Ebbitt House.

Jesse Bunnell, much wealthier, a very little older and no less fond of a joke than when he used to climb a high stool to get at the instruments on the Pittsburgh press wire; Ralph W. Pope, representing electrical publications and many other things, just as the members of the Pope family always do; Thos. B. Coulter, the sixth auditor of the Treasury, who worked with Lang on the Pan Handle Road in 1867 and who has become a good politician without spoiling a good operator; M. W. Barr, a compatriot of O'Reilly in the days of bottle-neck insulators, big registers and small salaries; C. E. Topping, superintendent of the United States Express; E. B. McLees, of the Kerite Company; S. S. Garwood, of Philadelphia, and, Fred Royce, of course.

There was not a "*talky*" man in the Convention. Every member came up to the business in hand full of solid sense and clear ideas on practical subjects, and with a ready facility of expressing his ideas in terse, crisp speech. And it was a gathering of men of character and dignity.

Local committees who engage rooms for future meetings of the Railway Association, or any other organization, will do well to follow the example of Darlton in securing a place that was roomy, pleasant, retired and quiet, instead of locating in the midst of everlasting racket and confusion, as is so often done.

If anybody wants a photograph of the Railway Telegraph group, it can be had of George Prince, corner of Pennsylvania avenue and 11th street. GEORGE C. MAYNARD.

Washington, D. C., Oct. 18.

Why the Hon. Bourke Cockran Took Up the Kemmler Case.

"The way in which W. Bourke Cockran came to take hold of the Kemmler case is rather curious," said an intimate friend of that gentleman recently. "I have heard it intimated that he was employed by an electric light company, but that is not true. It was all because of a dog.

"Cockran has a remarkably fine dog and he is very fond of him. His wife, too, thinks a great deal of him. When the experiments were going forward at Edison's laboratory and at the Columbia College School of Mines, Cockran and his wife used to read of the suffering of the poor dogs which were made the victims of science. You know that at first the dogs howled piteously. He used to get very much excited over the newspaper accounts.

"One night Mrs. Cockran had finished reading a peculiarly graphic account of a dog's sufferings, when she said: 'Just think how terrible it would be if they would treat our dog like that.' Cockran sprang up and exclaimed: 'That law providing for execution by electricity is unconstitutional. I'll break it if I can.' When Kemmler was sentenced he immediately took charge of the case, although he knew he wouldn't get a cent."

* * At a meeting of the Cabinet held in Paris, October 12, it was decided to close the Exhibition November 6.

Electric Railway Men in Council.

THE ASSOCIATION OF AGENTS OF THE SPRAGUE ELECTRIC RAILWAY COMPANY MEET AT MINNEAPOLIS.

The Sprague Electric Association met at the West Hotel at Minneapolis on Monday, October 14th. The following officers were present: Edward Blake, president, Boston; C. M. Barclay, vice-president, Chicago; P. A. Dowd, secretary, New York. The following named Sprague representatives were present:

Frederick J. Sawyer, Boston; E. E. Higgins, Buffalo, N. Y.; G. W. Larue, New York; A. H. Chadbourne and Wm. Hazleton, Philadelphia; J. L. & C. M. Barclay, Chicago; J. R. McLaughlin, Detroit; C. W. Foote, Cleveland; J. G. White, Omaha; D. W. Guernsey, St. Louis; Mr. Jaynes, San Francisco; H. M. Harding, Chicago; R. B. Smith, Washington, D. C.; S. Z. Mitchell, Seattle, W. T.; J. R. Barnard, Asheville, N. C.; Mr. Jones, Wyoming; C. M. Ayers, Grand Rapids, Mich.; C. P. Stevens and F. Dowd, Denver, Colo.; M. D. Barr and Wm. Oswald, Louisiana; G. W. Mattran, Texas; W. R. Ingalls, Indiana; Dugald C. Jackson, Kearney, Neb.

Although the meeting was held with closed doors, the following report of the proceedings were secured by the REVIEW's representative through the courtesy of the officers:

The subjects discussed were of a business and technical nature of importance to all concerned. The business development of the power industry, the technical features of the Sprague system, the organization for foreign work, the manufacture of machinery and appliances, were all taken up in turn and thoroughly discussed to the end of effecting some few changes and improvements in the general business and the development of new fields for work. The meeting was addressed at various times by Messrs. E. H. Johnson and Frank J. Sprague, Hon. John S. Wise, and other officials of the Sprague Company. At the close of the Association meeting the members attended in a body the Street Railway Convention held in the same hotel, and participated to some extent in the discussions before that body.

One of the most interesting discussions had was the explanation of the legal controversies between the electric railway companies and the telephone companies. The Hon. John S. Wise was called upon by the Association to state what controversies had arisen and the result of such litigation. As the general counsel for the Sprague Electric Railway Company, Mr. Wise has been counsel or consulted in all the litigation which has taken place between the telephone companies and the electric railways operating under the Sprague system. These controversies have arisen in Akron, Ohio; Harrisburgh, Pa.; Chattanooga, Salt Lake City, Cincinnati and elsewhere. The effort has been made in various places by the telephone companies using the grounded circuit to obtain injunctions against the electric railway companies for alleged disturbances of the telephone wires, and failing in securing injunctions the effort has been to recover damages in actions at law for such interferences. Up to the present time Mr. Wise reported that no telephone company had succeeded in obtaining an injunction against the electric railways, and no action for damages commenced by the telephone companies has ever been successfully prosecuted to a judgment. In one or two cases, for the sake of peace, amicable adjustments have been made between the telephone company and the electric companies, by which the cost of necessary changes in the telephone construction was divided between the two. Mr. Wise proceeded at length to state the reasoning and the authorities upon which the electric railway companies have contended that they are not liable in any form of action for such disturbance, and qualified his argument by decided cases which satisfied his audience that he had given the matter thorough study, and that the law is on the side of the electric railway company. In his remarks he took occasion to say that this question of liability of electric railways was one in which all electric railways were interested, no matter under what system they were operating, and expressed a willingness to furnish the argument and authorities in favor of the railways to any company having legal controversy with the telephone companies.

One of the most interesting subjects discussed by the agents and showing the enterprise of the Sprague Company, is its recent determination to push its work in the department of mines and irrigation. So far this branch of electrical industry has been little developed, but it offers a boundless field for enterprise, and recognizing this, Mr. H. McL. Harding, the former general agent of the company, has removed his headquarters to Chicago, and has taken charge of the whole subject of mines and irrigation. It is believed with the use of conduit pipes and electric pumps a great revolution can be wrought in the matter of irrigation in the West, and that by this means the cost of irrigation can be greatly reduced and immense tracts reclaimed which could not be otherwise reached.

An elegant Pullman car, equipped with the new 15 horse power Sprague motor, was exhibited in actual operation near the hotel, and the members of the Street Railway Association were given every opportunity to observe the practical workings of the system, while the deliberations of the Western Electric Railway Association, which also took place during the week in Minneapolis, brought out many points connected with the operation of the electric street railways, of importance to all concerned. Organization is strength, and the Sprague Company evidently believes in it. The present meeting dispersed with a notable impulse in the way of enthusiasm and business enterprise, which has been so marked a feature of the Sprague agencies throughout the country.

The Western Electric Railway Association.

The Western Electric Railway Association met at the West Hotel, Minneapolis, Minn., on Monday evening, October 14, with President Johnson, of the Lafayette Street Railway Company, in the chair.

The following gentlemen were present: Mr. Claninshaw, Troy, N. Y.; Hon. W. F. Wright, Omaha, Neb.; J. A. Peavey, Sioux City, Iowa; G. E. C. Johnson, Lafayette, Ind.; W. L. Allen, secretary, Davenport, Iowa; E. D. Allen, Stillwater; T. J. Evans, Council Bluffs; W. Pain, Milwaukee; Dr. Everett, Cleveland, Ohio.

Owing to the fact that many of the delegates had not arrived, the meeting was adjourned until Tuesday at 10 o'clock.

On Tuesday, President J. J. Evans called the convention to order. In his remarks he stated that the object in calling the meeting was that information might be acquired that would aid in the working of electric railways.

An address was made by the Hon. John S. Wise on the subject of "Legislation for Electric Railways."

A few remarks were then made by President Evans in which he advised the use of a complete metallic circuit in the operation of electric railways, personal experience having taught him that in this way the cost of operation would be reduced and the efficiency increased.

Secretary Allen made some interesting remarks as to the comparative cost of cable and electric roads. His company had found that the repairs, renewal of commutators and copper brushes were the main expenses. This has to a great extent been overcome by the use of carbon brushes, although some trouble had been experienced with them in the grinding of the carbon dust into the insulation between the segments of the commutators. His company had also discarded the use of the fibre gear, and were at present using a cast iron one. By this change, the noise has been increased some, but not enough to annoy the passengers, and the cost being so much less for the iron gear that they had found it policy to make the change. They had burned out no armatures since the road started, the cost of repairs, renewals of gearing, commutators, etc., was somethir g less than $2,000 for the past year.

Mr. Johnson made some remarks relating to the operating expenses of his line, in which he stated that the trouble had to a great extent been overcome by the use of the carbon brush.

After some further discussion the Association adjourned.

ELECTRICITY FOR STREET CARS

The American Street Railway Association at the Minneapolis Convention Discusses Electric Traction.

A STRONG ENDORSEMENT OF ELECTRIC POWER.

The American Street Railway Association met at the West Hotel, Minneapolis, Minn., last week and remained in session October 16th and 17th. The following named officials of street railways of the country were present:

Frank E. Petit, auditor, Augusta & Summerville R. R. Co., Augusta, Ga.
Wm. Richardson, president, Wm. J. Richardson, secretary, and John G. Jenkins, director, Atlantic Avenue R. R. Co., Brooklyn, N. Y.
John N. Partridge, president, Brooklyn City & Newtown R. R. Co., Brooklyn, N. Y.
George W. Van Allen, president, and Charles E. Harris, superintendent, New Williamsburgh & Flatbush R. R. Co., Brooklyn, N. Y.
Henry H. Windsor, secretary, and Thos. C. Pennington, treasurer, Chicago City Ry. Co., Chicago, Ill.
John Harris, superintendent, Cincinnati Street Ry. Co., Cincinnati, O.
George B. Kerper, president, Mt. Adams & Eden Park Inclined Ry. Co., Cincinnati, O.
A. Everett, president, East Cleveland R. R. Co., Cleveland, O.
J. B. Hanna, secretary, Woodland Avenue & West Side Street R. R. Co., Cleveland, O.
Ezra Bimm, vice-president, Wayne & Fifth Street R. R. Co., Dayton, O.
Henry A. Sage, president, Easton S. E. & W. E. Pass. Ry. Co., Easton, Pa.
W. Kellogg, secretary, College City Street Ry. Co., Galesburgh, Ill.
J. C. Shaffer, president, Citizens' Street R. R. Co., Indianapolis, Ind.
George E. C. Johnson, president, Lafayette Street Ry. Co., Lafayette, Ind.
C. J. Ernst, secretary, Lincoln Street Ry. Co., Lincoln, Neb.
H. H. Littell, manager, and J. B. Speed, director, Louisville City Ry. Co., Louisville, Ky.
Winfield Smith, president, and A. W. Lynn, superintendent, Cream City R. R. Co., Milwaukee, Wis.
Robert K. Warren, president, Mobile Street Ry. Co., Mobile, Ala.
Samuel C. Hart, president, Union Street Ry. Co., New Bedford, Mass.
George Green, president, Forty-second Street and G. Street Ferry R. R. Co., New York City.
Benjamin Flagler, president, Arthur Schoolkopf, treasurer, and Frederick Dean, superintendent, Niagara Falls and Suspension Bridge Ry. Co., Niagara Falls, N. Y.
Francis M. Eppley, president, Orange Crosstown and B. Ry. Co., Orange N. J.
Theo. P. Bailey, secretary, Ottawa Electric Street Ry. Co., Ottawa, Ill.
J. H. Hall, president, and J. D. Hall, director, Fort Clark Horse Ry. Co., Peoria, Ill.
Thos. C. Barr, president, People's Pass. Ry. and Lombard and South Street Ry. Cos., Philadelphia, Pa.
John Q. Adams, secretary, Citizens' Pass. Ry. Co., Philadelphia, Pa.
Jesse Metcalf, president, and J. R. Bartlett, general manager, Union R. R. Co., Providence, R. I.
Benj. F. Owen, president, and John A. Rigg, superintendent, Reading City Pass. Ry. Co., Reading, Pa.
Charles Odell, president, and R. H. Brown, director, Naumkeag Street Ry. Co., Salem, Mass.
James F. Pearson, president, and F. H. Peavey, vice-president, Sioux City Street Ry. Co., Sioux City, Iowa.
Robert McCulloch, general manager, Citizens', Cass Avenue and Belefontain R. Rs., St. Louis, Mo.
Charles Green, president, People's Ry. Co., St Louis, Mo.
J. S. Minary, secretary, Southern Ry., St. Louis, Mo.
P. F. Barr, vice-president, and A. L. Scott, superintendent, St. Paul City Ry. Co., St. Paul, Minn.
Norman B. Ream, president, A. E. Lang, vice-president, and Wm. E. Hale, treasurer, Toledo Consolidated Street Ry. Co., Toledo, Ohio.
C. S. Gleed, president, and E. H. Littlefield, superintendent, Topeka City Ry. Co., Topeka, Kan.
Lewis Perrine, Jr., manager, Trenton Horse R.R. Co., Trenton, N. J.
Geo. W. Pearson, president, A. A. Wilson, vice-president, and Robert Beall, director, Metropolitan R. R. Co., Washington, D. C.
H. Hurt, president, Washington and Georgetown R. R. Co., Washington, D. C.
John Jones, director, and Edwin W. Heald, general manager, Wilmington City Ry. Co., Wilmington, Del.
Chas. B. Pratt, president, and H. S. Seeley, treasurer, Worcester Consolidated Street Ry. Co., Worcester, Mass.
Walker G. Howey, superintendent, Grand Street and Newtown R. R., Brooklyn, N. Y.
Thos. J. Evans, director, Omaha and C. B. Ry. Co., Omaha, Neb.
W. J. Broadwell, Kansas City, Mo.
B. E. Edwards, president, Geo. F. Gund, vice-president, and W. W. Cargil, director, La Crosse Street Ry. Co., La Crosse, Wis.
R. D. Apperson, superintendent, Little Rock and Citizens' Ry. Cos., Little Rock, Ark.
Charles Williams, president and Geo. H. Knowles, general manager, Manchester Street Ry. Co., Manchester, N. H.
Geo. H. Knowles, president, Nashua Street Ry. Co., Nashua, N. H.
C. E. Parcell, superintendent, Tampa Street Ry. Co., Tampa, Fla.
Leslie D. Thomas, secretary, Terre Haute Street Ry. Co., Terre Haute, Ind.
T. E. Connelly, treasurer, and John N. Akarman, general manager, Elizabeth and Newark Horse R. R. Co., Elizabeth, N. J.
Amos F. Breed, president, and E. F. Oliver, secretary, Lynn and Boston R. R. Co., Boston, Mass.
D. M. Sweetser, treasurer, East Middlesex R. R. Co., Boston, Mass.
Edward Reardon, director, F. H. Monks, general manager, and Louis Pfingst, master mechanic, West End Ry. Co., Boston, Mass.
H. M. Thompson, secretary, Wm. N. Morrison, superintendent, D. Sullivan, superintendent, and Andrew Murphy, trackmaster, Brooklyn City R. R. Co., Brooklyn, N. Y.
Henry M. Watson, president, Buffalo Street R. R. Co., and secretary Buffalo East Side Ry. Co., Buffalo, N. Y.
G. George Browning, treasurer, Camden Horse R. R. Co., Camden, N. J.
H. H. Littel, president, and H. M. Littel, general manager, Cincinnati Inclined Plane Ry. Co., Cincinnati, O.
Henry Martin, president, Mount Auburn Ry. Co., Cincinnati, O.
Charles Hathaway, Jr., superintendent, St. Clair Street Ry., Cleveland, O.
J. N. Partridge, director, Christopher and 10th Street R. R. Co., New York City.
Geo. Bullock, general manager, South Covington and Cincinnati St. Ry. Co., Covington, Ky.
Charles B. Clegg, director, Dayton St. R. R. Co., Dayton, Ohio.
Samuel Hill, president, A. S. Chase, secretary, Duluth St. Ry. Co., Duluth, Minn.
Wm. H. Sinclair, president, Galveston City Ry. Co., Galveston, Tex.
Wm. H. Sinclair, president, and H. F. MacGregor, vice-president, Houston City St. Ry. Co., Houston, Tex.
Thos. W. Stevens, director, Steinway and Hunter's Point R. R. Co., Long Island City, N. Y.
J. B. Speed, director, Central Passenger Ry. Co., Louisville, Ky.
R. Semmes, superintendent, Citizens' Railroad Co., Memphis, Tenn.
Henry C. Payne, vice-president, Milwaukee City Ry. Co., Milwaukee, Wis.
Thomas Lowry, president, C. G. Goodrich, vice-president, E. H. Center, secretary, D. W. Sharpe, superintendent, Minneapolis St. Ry. Co., Minneapolis, Minn.
Chas. Odell, president, W. B. Ferguson, superintendent, E. P. Shaw, director, and E. Sumner, secretary, Newburyport and Amesbury Horse R. R. Co., Newburyport, Mass.
C. Densmore Wyman, vice-president, C. P. N. and E. R. R. R. Co., New York City.
Wm. Richardson, director, Dry Dock, E. B. and B. R. R. Co., New York City.
J. R. Bartlett, vice-president, Pawtucket St. Ry. Co., Pawtucket, R. I.
John G. Holmes, president, Citizens' Traction Co., Pittsburgh, Pa.
C. C. Woodworth, secretary, Rochester City and B. R. R. Co., Rochester, N. Y.
Chas. Cleminshaw, president, Troy and Lansingburgh R. R. Co., Troy, N. Y.
Chas. White, president, Andrew Glass, superintendent, Capitol, N, O St. and S. W. Ry. Co., Washington, D. C.
H. Hurt, president, and G. T. Dunlop, director, Washington, D. C., and Georgetown R. R. Co.

The ELECTRICAL REVIEW was represented by D. B. Dean, Chicago.

The meeting was called to order by President Geo. B. Kerper, of Cincinnati. In his address the president referred to electric power as follows:

"The past year has been one of changes in the motive power of street railways. Rapid transit is in demand, and through it great progress has been made in the advancement of street railway traffic, great prosperity to the cities receiving its benefit, and to the companies that have adopted it. Electricity and cable power are the systems coming into general use, with the former in the lead. The overhead electric system has thus far been demonstrated to be the most practical; but it is the hope and wish of every street railway manager that the system will be superseded, and that the motor of the future, be it electricity, gas, air, steam, or some other power, must and will be a motor independent of a central plant or a wire circuit. The demand for such a motor has enlisted capital and labor of a quantity and quality that is certain to bring about the desired result within a very short period. The horse and mule have been our faithful allies; they have nobly done their share in enabling us to build up cities and towns, and to establish therein a service which has added much to the happiness, comfort and prosperity of all classes. In return for their faithful service we propose to emancipate them and return them to the farms from whence they came; or, in the language of the negro who for the first time saw the electric car, when he exclaimed, 'White man freed the darkey first, now he freed the mule!'

"The magnitude of the interest we represent, even under the slow movement by horses, when compared with the passenger traffic of the steam railroads, is almost beyond conception. The steam railways of the United States, during the year 1888, carried 451,000,000 of passengers; while the street railways of New York State alone carried over 360,000,000, and this, with nearly 200,000,000 carried by the elevated roads of New York City, makes the total street railway traffic of New York State 100,000,000 in excess of all the steam railway passenger traffic of the United States. With the new systems, the carrying capacity, by the increased facilities and the rapid movement of the cars, is more than trebled. The travel is increased in the same ratio. Lines are extended to suburban towns and villages many miles distant from the city that they lie adjacent to. All this has been made possible by rapid transit."

The executive committee, in their report, which closely followed the convening of the Association, speaking of electricity, said:

"During the last few years each succeeding year has seen electricity progress far more rapidly than any other motive power that has come to our notice; and this has been especially so in the organization and operation of new roads. There is a peculiar fascination about electricity, lying perhaps as much in the fact that it is an altogether unknown quantity to most of us, and wholly understood by no one, as in the known fact of its adaptability to so many forms of usefulness, all conducing to the comfort and well-being of the human race. The sight of a car propelled, signaled and lighted by electricity is most attractive, not only to a street railway man, but to every one who has occasion to ride in the car. To no one department of our business has so much attention been paid, during the last year especially, as to that of motive power. At best we have come to regard the street railway as a machine by which horses are altogether too rapidly used up; and for reasons of humanity, if for no other, the managers of street railways feel that they should do all in their power to substitute some other motive power for that of animals. If, and when, it is practicable to do this at a much less cost, to say nothing of the greater satisfaction in operation, it is manifestly our duty to do so."

TREASURER'S REPORT.

The following is a summary of the report of the treasurer:

RECEIPTS.

Balance, Oct. 17, 1888		$2,587.36
138 Annual Dues, at $25	$3,450	
1 " " 15	15	3,465.00
11 Admission Fees, 25		275.00
Tickets to Washington Banquet		140.00
Interest on Loan		42.74
Sale of Annual Reports		10.00
		$6,521.10

EXPENSES.

Washington Banquet	$2,025.00
Secretary and Treasurer's Salary, 11 mos.	1,375.00
7th Annual Meeting and Report	845.05
Legal Opinions	209.25
Special Committee Reports, 1888	200.00
8th Annual Meeting	153.98
Postage	140.00
Miscellaneous Printing	115.19
Insurance, Expressage, Telegrams and Stationery	13.87
	$5,077.34
Balance, Oct. 10, 1889	1,442.76
	$6,520.10

The following is

THE REPORT OF THE COMMITTEE ON "ELECTRICITY AS A MOTIVE POWER."

To the President and Members of the American Street Railway Association:

Your committee appointed to report upon "The Conditions Necessary to the Financial Success of Electricity as a Motive Power" begs leave to submit the following:

The subject of "Electricity as a Motive Power" has been the all absorbing topic before our meetings for the past two years, and only now are we able to give any satisfactory answer. Up to the date of our last meeting, in Washington, October 17, 1888, we had made very little progress in the application of electricity to the propulsion of cars, although a solution of the problem was deemed not far distant. At that time the number of roads equipped and operated by electricity could be counted upon the fingers of your two hands, while to-day they number in the hundreds, a surprising result, all within the short space of 12 months.

This result could only have been brought about by the fact that the experiments heretofore made had proved a success far beyond even the expectations of those making them, and we have established to-day without a doubt the success of electricity as a motive power. Having ascertained this point, we are next led to the question, "What Are the Conditions Necessary to the Financial Success of Electricity as a Motive Power?" This question, while it can be answered in a general way, must, upon the whole, rest with us individually.

In the application of electricity we are not met with the *volume of business* or the *engineering and mechanical construction*, as brought to our attention from the report upon the "Conditions Necessary to the Financial Success of the Cable Road," but can simply say that if it is desired to make a change from horse-power, electricity will fill the bill to perfection, no matter how long or short the road, or how many passengers are carried. In the investigation of the subject, the most satisfactory results have been shown; it not only increases traffic over the road, but reduces expenses, and will enable us to operate a line, which heretofore entailed a loss, at profit.

We have three methods of operation, as follows: The overhead wire, the conduit, and the storage battery, which will accommodate all conditions.

For the overhead wire, we can only say that it is all that can be desired, and for suburban roads and small towns, and even in cities, at present cannot be equalled. The conduit has found very little favor in the eyes of practical men, by reason of the unsatisfactory result heretofore attained by those who have experimented with it, while the storage battery is gradually but surely pushing its way to the front as the most perfect system, and is now only awaiting the development of a battery which will stand the hard knocks and usage which it must necessarily get in the operation of a street car without destroying its component parts.

The overhead method, having been demonstrated to be the cheapest of the three methods, is being universally adopted, and with results that cannot but help keep it in the front ranks as a cheap power to propel cars. We have yet to learn of any person who has seen the operation of a road by this system, and have ridden in the cars, who has not declared it, without reservation, to be just what was wanted. In the large cities we are met with the objection to overhead wires, which necessarily compels us to favor the storage battery, and yet, if the consent of councils could be obtained, there is no doubt that the overhead construction would be placed in operation at once.

If a chance be desired in the manner of operating a road, we are not compelled to figure an elaborate cost of construction, which, if of cable, would cost something like $70,000 to $75,000 per mile, in addition to the cost of a power plant, but are only confronted by the small amount of, say, from $2,000 to $3,000 per mile, with cars costing from $3,000 to $5,000 apiece, while for the storage battery we have a figure still less, by reason of the wire being dispensed with, so that a comparative statement of the cost of construction of a 10-mile road complete, with 15 cars, would stand probably as follows:

Cost of cable construction	$600,000
Cost of power plant	125,000
Cost of cars	15,000
	$840,000
Electrical overhead wire construction:	
Cost of road bed	$70,000
Cost of wiring	30,000
Cost of cars	60,000
Cost of power plant	30,000
	$190,000
Storage Battery:	
Cost of road bed	$70,000
Cost of cars	75,000
Cost of power plant	30,000
	$175,000

In the above cases of electrical construction, the motor car would be capable of pulling one or two tow cars, if necessary. These figures your committee have no doubt will be found to be calculated within a reasonable limit of cost.

Now to get the most economical service and the best results, it would be well in the judgment of your committee to rebuild your road bed, if an old road, and start with a construction that would be as nearly perfect as possible, and that to be a girder rail construction, with ties two feet six inches apart, 5x10 yellow pine, your rail to weigh from 45 to 60 pounds, the weight to depend upon the traffic that would in all probability be carried upon it.

This is no doubt the most important step after deciding to adopt electricity; by this means you reduce the amount of wear and tear on your cars to a minimum, and prevent to a certain extent the damage to your motors, or if a storage battery, the constant jarring of your batteries. It will also enable you to maintain a more even rate of speed, as also a much faster rate, than could be obtained under any other condition. It is advisable, also, to have your motors examined after each trip, and see that nothing is out of repair. Do not let the motors work at a disadvantage, as a dollar or two, expended at the proper time, will save you hundreds in the future. Also see that the men running your cars are careful and capable of exercising a little judgment. A careless man will ruin your motor in a short time by forcing the whole current through it, when there is no reasonable excuse for the same; particularly in starting the cars a little attention in this direction will amply repay you for the time and expense devoted to such inspection.

If you are running a number of cars it will probably be more economical to put in your own power plant rather than depend on an electrical light plant, or it may be absolutely necessary to put it in by reason of having no such source of power. This plant need not necessarily be placed along the line of your road, as the power being transmitted through a wire, the plant can be placed where the cost of running the generators will be the least, which if water is at hand, or if in a coal district, would tend to materially reduce the cost; yet, for ordinary purposes, power can be leased from any electric light plant at a reasonable cost per car per day.

As to your cars the majority are now ordinary 16 ft. bodies placed upon independent trucks, so that old cars can be utilized; but if a new equipment is desired, it would be best that the bodies be placed upon independent trucks and that both ends be closed, or in other words, a bow window front and back, with the side entrance clear as in the ordinary car. Or, if your road is a double track with "loops," and your cars run but in one direction, it would be still better to have the front entirely closed as in the construction of the latest style of cable cars. This construction of the car will protect that portion of the electrical apparatus which is now exposed to the elements, and still make a much neater car; or, if your road carries a large number of passengers, a 20 to 22 ft. car upon double trucks, the same pattern, would give even better results.

With the small cars, have at least two motors of 15 horse power each, and with the large ones it is a question whether or not the motors should be 20 horse power each. Do not stint the power of your motors. There is no doubt in the mind of your committee that considerable of the trouble heretofore experienced has been for the want of sufficient motor power. With this power under your cars and the wire overhead, you may safely climb grades of 10 per cent. and more, with perfect ease, but with the storage battery it is hardly safe to claim a grade of more than six per cent.

The question of operating your line during the winter months is also a serious one, but there is still no doubt that if the rail is kept clear, little or no trouble will be experienced. To do this it is desirable, in addition to a plough, to use a large sweeper operated by

two 15 horse power motors, with the brooms working independent of your gear, and propelled by a separate 15 horse power motor, using at your curves and switches some little salt to keep them clear. This will keep your rail as clear as required under ordinary conditions, and in addition to the above, you should have attached to the cars a small scraper in front of the wheel, to keep the accumulation of snow or ice from the track that may be thrown there by the traffic on the street.

Now to the cost of operating your road. This will rest solely with yourself. It should not under any circumstances exceed 10 cents per mile to include the cost of your conductors and drivers. Of course, there are exceptional cases where the cost is much greater by reason of conditions which do not exist ordinarily. It was the desire of your committee to be able to furnish you with exact figures on this particular point, but it was found almost impracticable, as the majority of those from whom the information was sought preferred not to disclose the cost of running their roads.

A few figures showing the gross earnings, as well as the operating expenses for some of the months of the past year on roads operated by electricity, will probably be interesting, although the names of the roads will be withheld.

Operations of a road for the month of August 1889:

Gross earnings from operation	$3,821 95
Total operating expenses	1,856 67
Showing the net earning to be	$1,965 28

and in the operating expenses of this month were included $480, interest charges on floating and bonded debt.

Total mileage for the month, 19,181 miles; average cars operated, 8; average cost per mile per day for operating road, .09.67 cents; deducting amount of interest charges will give .07.12 cents per mile, which is certainly a very satisfactory showing.

For the first 31 days of operation of another road we have:

Receipts	$8,796 40
Expenses	2,164 00
Showing net earnings to be	$6,632 40

with motors making 19,930.5 miles, and of tow cars making 11,610.1 miles. Average motor cars operated daily, 5.93.

This shows a cost per mile of motors of only 10.86 cents, and by adding the additional mileage of tow cars, reduces the cost per mile to a figure of 6.86 cents. In this case it would be well to note that the cost of power was reduced to the average of $1.39 per car per day.

Again, we have for another road for the month of July, 1889:

Receipts	$10,605 00
Operating expenses	3,735 00
Showing net gain of	$6,870 00

with the motors making 46,647 miles; showing average expense per mile, .08.01 cents.

For another road we have:

Receipts from operating 80 days	$5,500 80
Total operating expenses	2,441 27
Showing net earnings for that period	$3,05953

Another road for 75 days:

Receipts	$6,182 15
Total operating expenses	2,843 54
Showing net gain for that period	$3,446 42

Last, but not least, we have a report of a road for the month of August, 1889:

Operating receipts	$4,317 46
Total expenses	871 04
Net profit	$3,446 42

The total expense of this road figures at 14 cents per mile.

The average number of miles that an electric car should make under favorable circumstances is at least 120 miles per day, of 18 hours, which is 50 per cent. in excess of what we can now get from horses.

It will perhaps interest some of you to listen to a few extracts from a letter written by one operating an electrical road, in which he says: "We find a flattering comparison in favor of the electric motor, and have experienced great difficulty in keeping the people off the roof of the cars, so anxious are they to ride; have carried them on the brake beams, hanging out of the windows, and on coupling bars. A single car, whose seating capacity is 22, has carried 102 passengers in one load. We have experienced no difficulty whatever in carrying these loads up the steep grades of our city. We can further state that in our six miles of track we have but one block without a grade of from one to 11 per cent. So great has been the increase of travel, since we began to use the motors, in place of horse cars, that we have already found it necessary to quadruple our equipment."

The instance stated above is only one of many from roads operated by electricity; all of them show an increase in traffic, and paying large dividends to the holders of the stock.

The most notable instance of the past year has been the resolution of the board of directors of the consolidated roads of Boston to equip their whole system with the overhead wire. A portion of this system has already been equipped, and from the statement of President Whitney, we have the fact that on their extension to Arlington of the Cambridge division there has been at least 150 per cent. increase in traffic, with 50 per cent. decrease in the operating expenses, giving us a net gain of 200 per cent., which is something marvellous.

We have had, unfortunately, within the past month, a report of the breaking down of the overhead system in the city of Richmond, and yet with all the results from reports as to the success of the overhead system, we will have some few who will bring this road up as an example of what the future will be of roads operated by the overhead wire. Why this should have occurred in Richmond is hard to tell, and can best be explained by some one with a knowledge of the cause.

The question of the relative merits of the different systems of electrical construction it has been thought best to leave open to discussion by the members of the Association.

In closing, would say, it has been stated that electricity, as a motive power, is as far ahead of the cable as the cable was an advance over horses. THOS. C. BARR,
Committee.

The discussion that followed the reading of this report was quite earnest and full of interest. We give it at length herewith:

DISCUSSION ON ELECTRICITY.

Mr. John S. Wise: I represent, as counsel, the Sprague Electric Company, which has been slandered so much in connection with the electric railway at Richmond. I desire to make a statement here as to the condition of that road and the causes of its failure, which I think will be satisfactory to any impartial mind. The Richmond Union Passenger Railway Company was chartered by the State of Virginia and the city of Richmond, through the influence of Mr. Maurice B. Flynn, of New York, who came with his companions and obtained that charter, and made a contract with the Sprague Company for the equipment of the road. In the first place, it was a scheme to put in a shoe string and pull out a tanyard. It was not backed by the proper capital at its beginning. It was a very desirable charter, it was a very desirable enterprise for an electric railway equipment company. The Sprague Company, in its anxiety to obtain the largest and longest electrical railway in the world, concluded a contract with Mr. Flynn. The track was laid, I believe, with second-hand rails; at any rate, many of them 30 pounds to the yard, of the lightest and most inferior kind, and to-day the rails all along that road are slivered off, as if they had been hammered. There is not a plumb rail on the road. The curves were 24-feet curves, and they were not bound in any way. The road was not ballasted from one end to the other. That was the character of the work which the owners of the road had put down, and to-day it will take $13,000 dollars to put the track in any condition at all; and with that the electric company had nothing to do. The cars were bought from J. G. Brill & Company, and have been there only two years, yet they are in a horrible condition; they are dirty and neglected. They look as if they were 20 years old. For many months they had employed blacksmiths to repair the motors, and had used brushes which were of such inferior material that they would be destroyed in a single trip; and with the foolishness of ignorance they absolutely undertook to manufacture dynamos in their shop. Finally, the inevitable result came. As to the system being abandoned, the statement is without authority. The fact is that the Sprague Company saw that its interests were imperilled by the parties who had obtained control of this road. We are in sympathy with the bondholders, and in co-operation with them to-day; and are endeavoring to restore the property to the condition in which it should be. We filed a bill to put it in the hands of a receiver, and take it away from these incompetent people; and have so far succeeded that the only reason it has not been done is that every overture has been made to us, and every promise and assurance given, that a radical change will be made in this incompetent management, and the road put in a condition so that this general subject may receive justice, as well as the particular road directly interested. Within the next three months we will show to the people of Richmond some radical changes, and on the road that was the first electrical railway we will show them the best electrical railway in the world.

Dr. A. Everett, president of the East Cleveland Railroad Company: I am no talker, but will say that we are running on our road 30 motor cars to our full satisfaction. We run about 15 miles of road, and make an average on a motor of 15 hours a day about 128 miles. In connection with the motors we make 80 miles a day with the tow cars. The road is running to my full satisfaction. It is the Sprague system.

Mr. C. J. Ernst, of Lincoln, Neb.: I am glad to hear from Dr. Everett, and as his road is just about the same length as mine, would like to ask him a question, and that is the cost per mile of operating his road, including all expenses of management; in fact, expenses of every kind.

Dr. Everett: I cannot answer that question, and for this reason: In my repair shop I am doing new work all the time, equipping new cars as fast as I can get the motors. My men work on new work for an hour or so, and then may be called upon repairs for an hour or so, and I have not been able to keep a correct account. I have no doubt at all it is a very great saving over horses. In my opinion, the exact saving cannot be told until the motors have been used for five or six years. The cost depends very much on the wear and tear of your motors. If the electric motor will last as long as the average life of a horse (my horses last about three and a half years), then the electric motor is cheaper.

Mr. Richardson, of Brooklyn: Have you used up any motors since you have been running?

Dr. Everett: We have not used up any, but we burnt out a number when we first commenced running. We have overcome that difficulty wholly, and have not had one burnt out for three months. The most trouble lately is with the commutators, but no doubt that can all be overcome. We have made improvements since we first started. The heaviest grade is three and a half per cent.

Mr. J. G. Jenkins, of Brooklyn: I would ask the question how are the passenger receipts as compared with the horses. Are people induced to ride more frequently with electricity?

Dr. Everett: A great many people ride out of curiosity. On an extension of two and three-quarter miles half of the people who ride in fine weather do not get off the car, but go right back with us.

Mr. Jenkins: I understand, then, your receipts are largely in excess of what they were when you operated by horse-power?

Dr. Everett: Comparing August and September this year, to the same months last year, the increase is about $6,000, or about 15 per cent.

Mr. J. H. Hall, of Peoria: What is the power of the central station engine?

Dr. Everett: Three hundred and thirty-five horse-power; we had 1,200 horses.

Mr. Hall: How many cars do you operate daily?

Dr. Everett: We operate about 60. We have 32 motors; each motor can haul two other cars.

Mr. F. H. Monks, general manager of the West End Railway, Boston: The West End Railway Company has at this time in operation about 50 motor cars, operating some 30 miles of single track. It is giving great satisfaction to the public and to ourselves. It has been stated in a letter, which has been read here to-night from President Whitney, that the receipts on the Arlington line are very largely increased, and that the road is giving general satisfaction. We are using the Thomson-Houston system. It is absolutely impossible for me to say what is the cost of operating the system, by reason of the fact that we have a contract with the Thomson-Houston Company by which they practically agree to keep the motors in repair and the overhead line in repair; and hence I cannot say much as to the cost per mile for operating. That seems to me to be largely a matter depending on locality, the price of coal, the price of labor, the price of real estate, etc. Many factors enter into the matter, so that each locality, and each person in each locality, must determine for himself. We are running a line from Park square, in Boston, to Chestnut Hill and Allston, and we are taking a large number of passengers who formerly rode on the steam cars, and we are giving great satisfaction. I met a gentleman to-day who said he lived near Allston. He said, "Now I am well suited; when you ran by horses I was not." We are running cars on that line, in trains, on 15 minutes time; we meet with another line at Collidge's corner, so called, and have a seven and a half minute line from that point in. I do not desire to take your time and tax your patience, Mr. Chairman, but would be glad to answer questions that may be asked, and perhaps thereby give you some enlightenment in regard to this matter.

Mr. William Richardson: I hope the gentleman will feel no embarrassment, for we are all anxious to know how the West End Company is proceeding in this matter; as to speed, the probability of its permanency, as regards the economy and efficiency of the plant, and generally whether the West End Company expects to so perfect this system of electricity that it will embrace all its lines in the city of Boston, or whether it has adopted it for use merely on its suburban roads.

Mr. Monks: It is quite impossible at this juncture to foreshadow what the future will be. I understand the wish of the directors to be to make very extensive additions to the present electric plant. It is expected where we have 50 electric cars in operation at the present time, to have at least 130 in operation by the 1st of January. The present lines are now entirely equipped with the Thomson-Houston motor; and new lines are to be equipped from the most thickly populated and congested part of the city to Franklin Park, and it will supply a very abundant population. It is not expected that further additions will be made before winter. The operations in the spring will probably include a very large amount of new line to be added. We run at an average speed of 12 miles an hour in some localities, at others a little faster. Between Arlington and Harvard square, stopping at 13 different places, where the time was previously 35 minutes, we make it now in 20. It is almost four miles. As you will observe, it was a pretty sharp run for horses in 35 minutes; we can make it now in 20 minutes.

Mr. Richardson: If I am correctly informed, the West End Railway Company has the right granted to it to run by electric power on every street in the city of Boston.

Mr. Monks: Where they are now at present.

Mr. Richardson: I did not know of the limitation. Can the gentleman tell us whether the success of the matter thus far has been such that the directors of the company feel confident that they can in the future, safely and practically, in all their senses, operate their different lines by electrical power instead of horses, or is it still in the experimental stage?

Mr. Monks: I think I may safely state that the experimental stage has been passed. It is impossible for me to promise to a definite certainty that the whole of the 7,500 horses will be superseded by electricity. The future will show. Suffice it to say that the company is launched upon the enterprise; and I have no question whatever but there will be extensions made during the coming year, in addition to those now contemplated.

Mr. Jenkins: It seems from what the gentleman has said that one of his lines now operated by electricity had been operated by horses. Is there a greater or less expense in operating by electricity than by horses.

Mr. Monks: As I said before, I cannot say what the cost of operation is; I do not know the cost to the Thomson-Houston Company under our contract with them.

Mr. Jenkins: That is a matter of secrecy between your company and the operating company, what the expense is?

Mr. Monks: I cannot be expected to disclose that.

Mr. Flagler, of Niagara Falls: Have the experiments of your company been confined to this one system, or have you used other systems?

Mr. Monks: We have used three systems, sir.

Mr. Richardson: At the same time, or did you experiment with them separately, and then finally settle on one?

Mr. Monks: We used three systems at one time.

Mr. Richardson: What systems?

Mr. Monks: The Sprague system, Bentley-Knight system and the Thomson-Houston system.

Mr. Jenkins: Now you have but one?

Mr. Monks: Yes sir.

Mr. Jenkins: We are to draw our own conclusions from that.

Mr. Richardson: I would like to ask whether from the gentleman's experience with the system he speaks of as being operated at fifteen minutes and seven and a half minutes apart, a road which needed to be operated with cars at intervals of two minutes on a road of four miles in length could, in his judgment based on his experience and observation, safely adopt this system of electricity, and with such a system could safely depend on being able to operate the road successfully?

Mr. Monks: In answer to the question, let me say that on our Franklin Park division we have 2,000 horses. We have a very large business there; our July receipts being $114,000. The people ride to the park in large numbers, it being a great public resort. Last summer we ran cars to the park on one minute headway over a very large portion of the day. If the same increase in our travelling takes place next summer with our electric cars that has taken place elsewhere with our electric cars, it is my expectation of being obliged to run cars at least 120 in the hour, in order to supply the demand. I have no hesitation from what I have seen of the system now in use that it is my belief that it will be perfectly practicable for us to do it in that way.

Mr. Lang, of Toledo: Do you use a metallic wire for the return current, or do you use the rails and an additional wire between the tracks?

Mr. Monks: We use the supplemental wire between the tracks, joining it to each rail, making a connection with the rail.

Mr. Lang: Have you experienced any difficulty with the telephone companies?

Mr. Monks: No, sir.

Mr. Lang: And does the city permit the overhead wires of all kinds to be constructed in the city, telephone, telegraph and electric railway wires?

Mr. Monks: There has been a general tendency in Boston, as elsewhere, to have the wires placed under ground. With that in view the conduit was laid in the first

place; but the conduit proved so impracticable, and the overhead wire at the same time proved so practical, that the citizens of Boston were anxious, even eager, to have us go ahead with the overhead system. In connection with this it may be proper to state that we are setting up poles on Tremont street. Everyone knows that Tremont street is down in the heart of the city, and that it is crowded all day and late in the evening with foot passengers and teams, and that there are a large number of shops on the street. We are now engaged in putting up our poles in that locality. We use an iron pole in three sections. I confess that when the poles were about to be placed there we had some misgivings concerning the possibility of putting the poles there, and one of our officers went and called in person upon the owners of property on the street. He was received everywhere with great courtesy and kindness, and it gives me great pleasure to say that not one man owning property on the street made any objection to having a pole placed in front of his store.

Mr. Lang: I would ask whether this line you speak of was laid with special reference to the use of electricity, or whether it was an old line?

Mr. Monks: In that connection let me say that our box cars weigh about 5,500 pounds, and our motor cars about 12,000. We have been running with box cars on that line for a number of years; we have a very large amount of stringer flat rail construction, which is amply good for the operation of horse cars for a number of years to come; but for the operation of electric cars it is clearly not sufficient, and we are now engaged in laying the very best possible construction we can find for the purpose of the proper operation of electric cars.

Mr. Richardson: What construction is it?

Mr. Monks: I would prefer not to advertise any private concern.

Mr. Richardson: I referred rather to the weight of the rail, and how it was laid—whether with yellow pine stringers. It is with a view to finding out whether it is necessary for a road now in existence and well constructed to be reconstructed for the use of electricity.

Mr. Monks: I think it is necessary to reconstruct.

Mr. Richardson: Do you design the rail with the joints irregular or regular?

Mr. Monks: We propose to make it with joints meeting. We determined that to be the better way of the two.

Mr. Richardson: What is the weight of the rail?

Mr. Monks: We use a 78 pound Johnson rail on chairs, and we use a 66 pound Johnson rail on chairs; we also use some Providence girder rail.

Mr. Cleminshaw, of Troy: Can you tell us why you make the joints meet?

Mr. Monks: We think it avoids the possibility of a rolling motion, which I understand from steam railroad engineers has been the effect. If the joints are laid, say not opposite, there comes after a while a sort of rolling, sideways motion, when the car drops on every joint; but when we keep the joints directly opposite the two will fall together, and there will be only a motion up and down in the cars. I looked the thing over very carefully, and that is what we determined.

Mr. Richardson: Is there any reason to suppose that what are called "live" wires will be attended with fatal results when persons come in contact with them?

Mr. Monks: No, sir.

Mr. Richardson: Our difficulty in Brooklyn, in getting the right to put up overhead wires, is the intense fear of their being dangerous to life and limb.

Mr. Monks: I think it is pretty generally understood in Boston that the pressure of current in our wire is not dangerous to life. As you know, in all electric roads we use a 500 volt current, and in many of the arc lighting systems a 3,000 volt current is used. I believe Mr. Edison says that between 800 and 1,000 volts, a current is dangerous. I have never heard of any serious injury result from contact with a wire carrying 500 volts.

Mr. Lang: Do you protect this wire by other wires strung overhead?

Mr. Monks: You mean guard wires?

Mr. Lang: Yes, sir.

Mr. Monks: That is our intention down town in the central part of the city.

Mr. Petit, of Augusta, Ga.: I would like to ask the gentleman what rate of speed is attained in the business portion of the city?

Mr. Monks: I cannot tell you that, by reason of the fact that our line is not projected in the business portion of the city; but I think we shall not be able to run faster than six miles an hour, on account of the fact that for some time to come we shall be obliged in the business portion of the city to run partly by horse power, the horse line occupying the same track.

Mr. Petit: What would be your opinion of using a 30-pound steel T rail?

Mr. Monks: I think it would be unadvisable; I should rather use a 54-pound rail.

Mr. Eppley, of Orange, N. J.: I was informed, on very good authority, that an accident occurred within six weeks in Scranton, Pa., something like this. There was a motor crossing a steam railroad track. It seems the motor got off the track, and the engineer put on the full electrical power; and by some means or other the electrical fluid connected with the steam railway rail. At that moment there was a horse and buggy crossing the track, and the horse stepped on the track and it was thrown head over heels.

Dr. W. L Allen, of Davenport, Iowa: My experience has only been with a small road, operating five cars. We have run four cars steadily since August 14th a year ago. At that time we were laid up five days on account of the lightning burning out one of the armatures in the station. We have kept an account of all the repairs of all the commutators, gears and all electrical apparatus. Our repairs have been on the five cars for renewals (the ordinary repairs have been included with operating expenses), such as commutators and gears for these five cars, $1,686 in 12 months up to September 1st. Our operating expenses have increased somewhat; that is they were about $10,800 with horse cars, and have been $11,200 with these five electric cars. On that road we have a grade of 7½ per cent. Our running time has been increased in this way; we ran 15-minute cars before, we run 12-minute now, and on busy days run on 10 minutes headway. We can make the trip on the road 10 minutes out and 10 minutes back; being two miles and a quarter. The earnings have increased very largely. It would not make much of a figure compared with these other roads, but the percentage has been nearly 50 per cent.; the increase in gross earnings has been $23,000 against $15,000. The operating expenses have somewhat increased; taxes increased and insurance increased. Our repairs were all included in the operation expenses, but the renewals were $1,680. We have had nothing to pay for armatures; we bought four field magnets, costing about $20 apiece. Most of the wear in our experience has been with the commutators. The brushes rub on this part, and they wear out rapidly. In June last we put on carbon brushes and they proved very satisfactory, and the wear and loss has almost been done away with. One man attends to the motors, and he works on the commutators; and if some of the wires get loose on the armatures, he has been able to fix them up. The cars make considerable noise, as a result; but the people do not seem to mind it. We use the Sprague system.

Mr. Cleminshaw: Could you run ten cars without increasing the expense in proportion?

Dr. Allen: We could run ten cars without increasing much the cost of moving the cars. We would have to put in another dynamo. It depends somewhat on the price of coal. Our coal bill has been four dollars and a half a day. Of course, in these places we get fuel very cheap; we burn sawdust in the summer to a great extent, and that costs very little.

Mr. Flagler: Was the rail changed on the track at Davenport, or do you use the old rail?

Dr. Allen: We use the old rail; it has been down 14 years.

Mr. T. J. Evans, of Council Bluffs: I have been operating a road between Omaha and Council Bluffs for about a year. We ran during the first four or five months in the winter six motor and six trail cars. When the spring opened we started in with 10 motor and 10 trail cars. We average 120 miles a day to each train, running about 15 to 18 hours. We have operated that road at an expense of about four cents per mile, including everything except the interest and the wear and tear of the machinery. It includes the labor, materials, fuel and renewals. We manufacture most of our renewals in our own shop. The length of the road was about 10 miles. During the summer we increased it to about 20, and put on 20 to 22 motor cars. Our expenses will be much less per mile now than before. The greater the number of cars of course the proportionate expense is less. We use the Thomson-Houston system. I do not think there is much difference in the cost of operating either system. We have never had an accident. We have had our men take the current, in its full force, time and again. I have taken it without harm. We pay our motor men and conductors two dollars and a half a day. Last winter we did not have much snow, but in place of it something that is worse for electrical railways, and that is sleet. We had a great deal of foggy weather, and the moisture freezes on the rail. It is far more more difficult to operate the overhead wire with sleet on the wire than it is with snow on the surface. We never lost a train, however, but kept our schedule time. We apply scrapers in front of the trolley to scrape the sleet off, and sometimes a man would ride on the top of the car and strike the wire and break the sleet. We run about 18 hours, and the motor car makes about 120 miles a day. We have never burned out a motor on the line; we have short circuits, defective wires, and other minor difficulties; but we never had to send a machine away to be repaired. I recently completed a road in Ottawa, Ill. It has been in operation about six weeks. We run single motor cars with one man. That line cost a cent and a quarter per mile per car for fuel. I have only eight motor cars; when they are increased to 12 or 15 it can be done for less than one cent a mile. About a week ago I took the eight motor cars, connected them together, and also four trail cars, making 12 in almost one line, and moved them four and a half miles from an 80 horse power generator, loaded with 830 people, mostly adults, and the train attained a speed of not less than seven and a half to eight miles an hour at any time, and at one time a speed of about 15 miles.

Mr. Monks: You speak of running these cars in a train, and that you use only one motor man. Did he control the brakes of all the cars, or how did you handle the rear car?

Mr. Evans: We have a conductor, and his place is on the rear car. We have never had any trouble in stopping. We stop with an electrical car, as you are aware, rather easy. Our brakes work well. We use a Pullman car brakes perfect, with the Bemis truck. We have no difficulty in stopping two cars with one brake. Of course, not so readily as if the conductor was on the rear car applying the brake at the same time.

Mr. Monks: You depend on the brake on the forward car for stopping the train?

Mr. Evans: Yes, sir; but not altogether. When the signal is given to stop, it is given by the conductor.

Mr. Monks: And he winds the brake on the rear platform?

Mr. Evans: Yes, sir. It is frequent that the motor man stops without the conductor's knowledge. He does it with one brake, both cars, without any difficulty. When the motor man takes up a passenger without the conductor's knowlege, he does it alone.

Mr. A. F. Breed, president Lynn & Boston Railroad Co: I do not think I can say much that will add to the information you have already got from the previous speakers. I think we were one of the first in our vicinity to adopt an electric road, which we commenced about a year ago last July, running about one mile. We operated that road during the summer, and it proved very successful. In the fall we commenced to build a road just two miles long in a circle, going around, so to speak, the outside of a shell, and encircling a large population through the central part of the city. We go up a nine per cent. grade and go down a thirteen per cent. grade. We go over eleven sharp curves and switches in travelling over the circuit of just two miles; so that I think we get as good a test as is possible. We commenced operating that road about one year ago, and it has proven very satisfactory in all respects. We run by the overhead system. I think we give electric railways as severe a test on our roads as is possible anywhere.

Mr. Eppley: How long is the 13 per cent. grade?

Mr. Breed: I should think about 1,500 feet.

Mr. Eppley: Whose system do you use?

Mr. Breed: The Thomson-Houston.

Mr. Eppley: Do you go down on the brakes or do you use the electricity?

Mr. Breed: We go down on the brakes.

Mr. Eppley: Do you ever ascend the entire 13 per cent. grade?

Mr. Breed: The other day, when there must have been 35 passengers on the car, as a little experiment, I told the driver to stop the car on the steepest part of the grade and reverse his current and go back, which he did. He stopped the car on the steepest part of the grade and moved the car back perhaps 100 feet.

Mr. Eppley: What speed do you think you could make going up hill?

Mr. Breed: I could not say positively; I think on the nine per cent. grade we could make perhaps six or seven miles an hour.

Mr. Petit: What does it cost you per car per mile?

Mr. Breed: I think that is a question no one can answer at present. I do not believe you can tell exactly what it costs. I know we get more riding, and I think we can run the cars cheaper than by horses.

Mr. Eppley: Can you tell what is the percentage of permanent increase in your business?

Mr. Breed: In the case of that particular line the people did not like to run by horses, on account of the steep grades, and the business was very light. I think the increase is large on that part of our system; I should say it was 15 to 25 per cent.

Mr. S. K. Short, of the Short Electric Railway: I want to call attention to the delegates to one or two points in connection with our system of electric railways. We have devised a motor, after a long experience and after a very conservative business policy, in which we think we have eliminated most of the difficulties which have been experienced by electrical engineers in electrical street car propulsion. We do not claim to have made a perfect system; we will not have that for s me years to come; but we have met and overcome most of the difficulties that have been experienced. We use an armature which is large in diameter, and that gives us, with the rotary feeder, a high speed of the bobbin of the armature. This enables us to run our gears at a very low speed. The pinions on the shaft are large, and we have cars that have been in regular service a year without these gears showing much wear; and we believe it is the slowness of speed which saves them. That has been a very serious difficulty, connecting the motor with the axle of the car wheel. We find that by the slow movement we can gain an advantage in wear. The bobbins on the armature are all separated, so that no excessive heat can be developed in it. We will guarantee that our armatures will not burn out. With these objections removed, these excessive repairs done away with, and these electrical difficulties overcome, it makes the motor a very economical means of moving street cars. Our expenses for operating in Huntington, West Virginia, are about two and a half cents per car mile, including everything but wages. In that city the cost of drivers and conductors is low, about $1.50 a day. We make an average of about 130 miles a day. We run our cars at a very high rate of speed in the suburbs. We use two systems of overhead construction. We have one system with two wires overhead. This we consider the most reliable and safest system when the constant current is used. We also use the single overhead wire construction, with the rail return. We use carbon brushes on the motors, and also removable segments on the commutators, so that they are not destroyed when they wear down. We simply take off the removable segments and replace them with new ones. These are only some of the main features of our system.

Mr. Richardson: Did your company put a road in operation in St. Louis?

Mr. Short: Yes, sir; we put up a construction and equipment of a mile and a half for the St. Louis Railroad Company. We are now extending the system three miles, and adding 18 more cars. It is the intention to run inside of 10 days.

Mr. Richardson: Did you take out the first equipment?

Mr. Short: We removed the poles, and put up heavier steel poles.

Mr. Richardson: The first equipment was not successful?

Mr. Short: The system was successful, and was operated successfully; but the construction was insufficient for the road. It was on the main portion of the Broadway line, which has a very heavy traffic.

Mr. Richardson: How many volts do you use?

Mr. Short: We use 500 volts on the potential system.

Mr. Richardson: How much on the double wire?

Mr. Short: One hundred and fifty to three hundred.

Mr. Louisville, of Kentucky, said he had heard a rumor that the Sprague system had transferred its business to the Thomson-Houston Company, and he would like to have a representative of the former company either confirm or deny the report, for the benefit of the Association.

Mr. Johnson, of the Sprague Company, replied that he wished to say, in reply to that particular rumor, that while his company could not undertake to reply to all the rumors made concerning the company, and the operation of its system, it was absurd; and he did not think anything more need be said. However, in justice to the Sprague system, and in justice to what has been said about it, he wished to call attention to the fact that when Mr. Sprague designed the apparatus for the Richmond road, he had no predecessors to tell him how to do it. He did it, the road worked, and as a result there are some 300 electrical roads in operation in the country to-day. This, he considered, was the best evidence that what Mr. Sprague did at Richmond had merit. The fact was that electrical propulsion had become an established industry; and he thought there was enough of business for all; and he depreciated most sincerely that attempt and all attempts of any company to advance their own interests at the expense of other companies. His agents were instructed not to follow that course and he did not care to address himself further to that branch of the subject.

The Association adjourned, after transacting a good deal of business relating directly to street railways.

ELECTRIC LIGHTING ITEMS.

—— The Fort Wayne Electric Company has again secured the New Orleans contract for city lighting.

—— The new engine and boiler for the electric light works at Brockport, N. Y., are being put in place.

—— The Thomson-Houston Electric Company has been invited by the Exeter, N. H., Board of Trade to erect an electric light and power plant in that city.

—— The Salem Electric Lighting Company is now running separate wires from Salem to Peabody, Mass., for the purpose of furnishing incandescent lights.

—— The Council Bluffs Electric Light and Power Company have disposed of their electric plant to the Sperry Electric Light Company, of Chicago. The consideration is supposed to be about $65,000.

KINDRED INTERESTS

The New England Electric Company, who control the Sprague motors in New England, report the following recent sales in Boston and vicinity: A. W. Stetson, passenger and freight elevators, 15 h. p.; Augustus Lowell, elevator and mechanical, 20 h. p.; Batchelder & Lincoln, three elevators, 25 h. p.; Boston Bank Note & Litho. Co., printing presses, 10 h. p.; F. M. Kingman, Brockton, shoe factory, 25 h. p.

The Wainwright Manufacturing Company, of Massachusetts, has recently redoubled its working force—an increase rendered necessary by the extension of the business. A 200 light Thomson-Houston plant has been put in at the factory. The Wainwright Company has just installed a 300 horse power feed water heater for the electric station at Pottsville, Pa., and another for 100 horse power at the Greenfield Electric Light and Power Company.

The Jarvis Engineering Company, of Boston, Mass., is selling a large number of Armington & Sims engines. Among recent orders are two of 135 h. p. to the Edison Electric Illuminating Company, of Boston, making seven of this size sold this company within six months. One of 50 h. p. to C. I. Hood & Co., Lowell, Mass.; one of 35 h. p. to Ray Woolen Co., Franklin, Mass.; one of 80 h. p. to Great Barrington Electric Light Co., Great Barrington; one of 90 h. p. to Marlborough Electric Light Co., Marlborough, Mass.; two of 100 h. p. each to Dedham Electric Co., Dedham, Mass.; one of 70 h. p. to Louisiana Sugar Refining Co., New Orleans, La.; one of 100 h. p. to Westboro Electric Light & Power Co., Westboro, Mass.; one of 50 h. p. to Bennett Manufacturing Co., New Bedford, Mass.; one of 100 h. p. to Bennington Electric Light and Power Co., Bennington, Vt.; one of 100 h. p. to Hoosick Falls Electric Light and Power Co., Hoosick Falls, N. Y.; one of 125 h. p. to Edison Electric Illuminating Co., Fall River, Mass.; one of 100 h. p. to Leominster Electric Light Co., Leominster, Mass. The Sheffield Grate Bars, National Feed Water Heaters, Korting Injectors and other specialties handled by the Jarvis Company, are meeting with a large sale.

The Ball Engine Company, of Erie, Pa., manufacturers of the Ball engine, have recently made the following sales:

		Engines.	
Brooklyn St. Ry. Co.	Cleveland, Ohio	2	125 h. p.
Willamette Bridge St. Ry. Co.	Portland, Ore.	1	80 "
Seattle E. R. & M. Co.	Seattle, Wash.	1	80 "
Edison El. Illum. Co.	Brooklyn, N. Y.	1	300 "
Meridian Oil Mills Co.	Meridian, Miss.	1	200 "
Akron St. Ry. Co.	Akron, Ohio.	1	150 "
Westches'r Co. E. L. Co.	Rye, N. Y.	1	80 "
Bellair Gas & El. Co.	Bellair, Ohio	1	80 "
Citizens' El. L. & P. Co.	Covington, Ky.	1	50 "
Marion Cotton Mills.	Marion, S. C.	1	50 "
Pioneer Iron Works.	Cienfuegos, Cuba.	1	60 "
State Reformatory	St. Paul. Minn.	1	50 "
Thomson-Houston El. Light Co.	Wilmington, N.C.	1	100 "
Sheriden Iron Works.	Champlain, N. Y.	1	80 "
Thomson-Houston International El. Co.	Iquiqui, Chili	1	25 "
August Klönne	Dortmund, N. Ger.	1	35 "
Redonda Hotel Co.	Los Angeles, Cal.	1	100 "
Murphy Varnish Co.	Newark, N. J.	1	25 "
Tacoma & Roach Harbor Lime Co.	Roach Har., Wash.	1	80 "

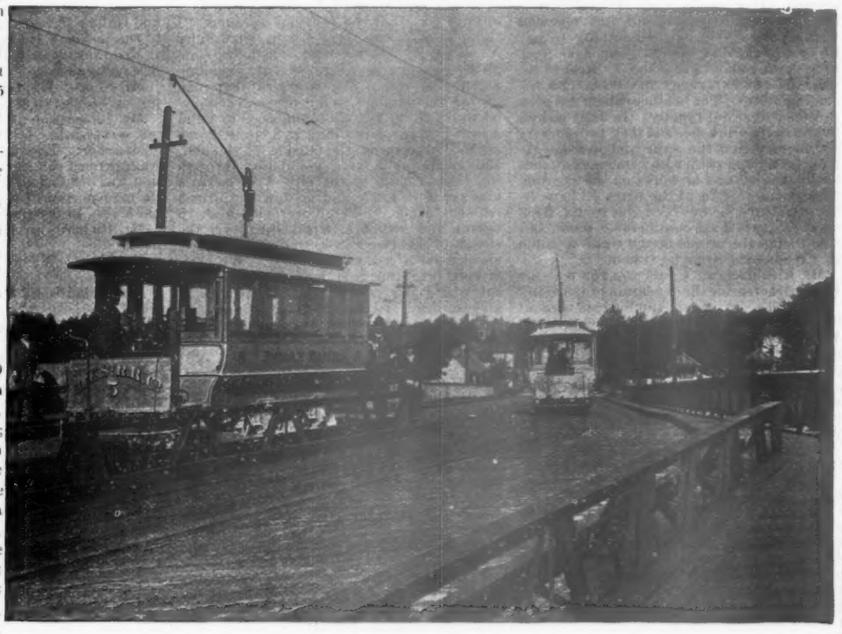
The Atlanta Electric Railway.

The Atlanta and Edgewood Street Railroad, using the Thomson-Houston system, commenced carrying passengers on the 23d of August, and is the first electric railway in the State of Georgia.

The line extends from the corner of Peachtree street and Edgewood avenue, the entire length of the latter street, a distance of two miles, to Inman Park, a lately opened residence part of Atlanta.

The track is standard gauge, and double for three-fourths of its length. It is built in the most substantial manner of 54 pound Providence girder rail, resting on stone piers set five feet apart, and two feet deep, and is without doubt one of the finest pieces of track in the country.

The maximum grade is 3.8 per cent. and the average 3 per cent., without a level stretch of over 100 feet in the whole line. The road crosses the Richmond & Danville Railroad (Piedmont Air Line) by a bridge 630 feet long on which there is an angle of 15 degrees, on a curve of 100 feet radius. The overhead work has been done in the best possible manner, and is noticeable for its simplicity and neatness. The construction of the reverse curve entering the car house is especially good, but two poles being used to support the main wire and both curves. Steel poles are used in the business portion of the city, and neatly trimmed wooden poles on the rest of the line, all being painted a dark green color, which renders them quite inconspicuous. The cross-suspension method is used throughout, the wires being supported at intervals of 125 feet, the construction being done under the supervision of Mr. C. E. Flynn, of the Thomson-Houston Electric Company.



The Atlanta Electric Railway.

The car equipment consists of four 16-foot closed cars, each furnished with two ten horse power motors attached to Brill trucks, and four 26-foot open tow cars. The cars were built by the Lewis & Fowler Manufacturing Company, of Brooklyn, N. Y. The car-house, located at Inman Park, is a handsome building, and is one of the best arranged for its purpose in the country. There is but one track entering the house, a Wharton transfer table being used to place the cars on any of the four tracks. The transfer table and inside tracks are electrically connected, the same as the outside tracks, and overhead wires are also stretched in the house, so that the cars never have to be moved by hand. The floor under the tracks is five feet below the rails, so that all parts of the trucks and motors are easily accessible for inspection and cleaning. The building is lighted by 25 incandescent lamps, in groups of five in series, the current being obtained from the railway circuit. The power is furnished by the Georgia Electric Light Company, using an 80 horse-power Thomson Houston generator, though the railway company has in contemplation the erection of a power station of its own.

Three cars are run from 6 A.M. until 8 P.M., making a 10 minute schedule, 30 minutes being allowed for the round trips, though it is easily made in 20. The average mileage per day for the two cars which run until 11 o'clock is 135, and for the other 112. The tow cars are run only on Sundays and special occasions when travel is very heavy, though the motors pull them heavily loaded up the long grades without difficulty.

Wyckoff Pipe Company.—This company is manufacturing at its factory, at Williamsport, Pa., a large quantity of tubing for underground wires. They are furnishing the New York and New Jersey Telephone Company, of Brooklyn, and also are making large shipment to Buffalo, Chicago and other cities of their underground conduits. It is pleasing evidence to the Wyckoff Company that a large number of orders have come in to them unsolicited, which would seem to indicate that their conduits are what the electrical people want.

The Edison Machine Works' new plant, at Schenectady, N. Y., grows rapidly. Already some 1,300 men are employed, and when the plant is completed probably twice that number will be required. One brick building 402x72 feet is now being erected. This will be a one-story building, and in it will be made all kinds of wire. A three-story brick building 167x50, now building, will be used for carpenter shop, pattern shop, etc. The present wire works will be used for machine work. The company also has under contract a new brass foundry, an iron foundry and a building for the manufacture of glass globes. At present a large amount of work is being done for the Sprague Motor Company, and motors are being sent to other countries to considerable extent. Schenectady appreciates this business.

For the Extension of the Electric System.—The West End Co. has placed an order with the Simplex Electric Company for the feeder wires to be used on the Franklin Park and Cambridge extensions of the electric roads. The Simplex Company shipped five car loads of wire West last week.

The Electrical Supply Company, of Chicago, have just issued their new illustrated catalogue of electric light and power supplies, No. 560. Taken as a whole this catalogue is the most complete and carefully prepared of any electrical trade book ever published. The company is a progressive one—Excelsior is its watchword—and this catalogue is an expression of its business policy. The book is of 320 pages, handsomely printed on heavy paper, and illustrates only the latest and most improved electrical devices. It has not been used as a vehicle to dispose of old goods more or less obsolete in their character. To give this book more than a general trade interest, it is not made simply a catalogue of their stock goods. Many valuable tables, electrical formulæ and reliable directions for general wiring, have been compiled by the most practical and well-known electricians in the country, and embody the result of the latest electrical investigation. These features give the book an individuality and value possessed by no similar publication. An artistic cover has been especially designed for this book which is in keeping with its general artistic character. This catalogue will be cheerfully sent to any one in the trade upon application.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON OCTOBER 16, 1889.

412,669 Thermo electric generator; William S. De L. Roberts and James S. Mollison, Sydney, New South Wales.

412,700 Regulator for dynamo electric machines; William H. Elkins, Cambridge, Mass., assignor two-thirds by direct and mense assignments to Arthur B. Griggs, Boston, Mass., and Polly Craig, De Funiak Springs, Fla.

412,713 Fitting and hoisting gear for electric lamps; Wm. B. Sayers, Lisbon, Portugal, and Wilson H. Sturge, Birmingham, Eng.

412,737 Secondary battery; Hiram H. Carpenter, Denver, Colorado.

412,758 Electric circuit closing driver; Wm. C. Johnson, Jr., Lynn, Mass.

412,818 Electrical switchboard; James J. Wood, Brooklyn, N. Y.

412,845 Push button; George E. Ely, Rochester, N. Y., assignor to Louis T. Riggs, same place.

412,854 Dynamo electric machine; John A. Kingdom, London, England.

412,889 Electric terminal; Chas. McIntire, Newark, N. J.

412,924 Electrical metal detector; Jesse F. Kester, Terre Haute, Ind., assignor one-quarter to Owen E. Duffy, Washington, D. C.

412,925 Electrically operated ice cutting machine; Frank E. Kinsman, Plainfield, N. J.

415,928 Governor or regulator for electric motors; Roderick McCrae, Baltimore, Md.

412,932 System of distributing by alternating electric currents. 412,933 Discharge driver for dynamos; Oliver B. Shallenberger, Rochester, assignor to the Westinghouse Electric Co., of Pittsburgh, Pa.

412,962 Incandescent lamp socket; Osborn P. Loomis, Somerville, Mass., assignor to the Loomis Electric Manufacturing Company, N. Y.

413,008 Alternating current machine; Charles Zipernowsky, Buda-Pesth, Austro-Hungary.

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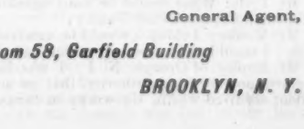

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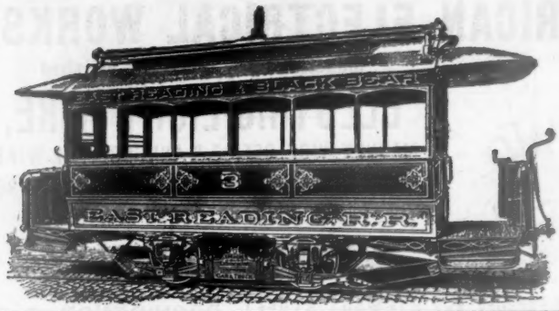

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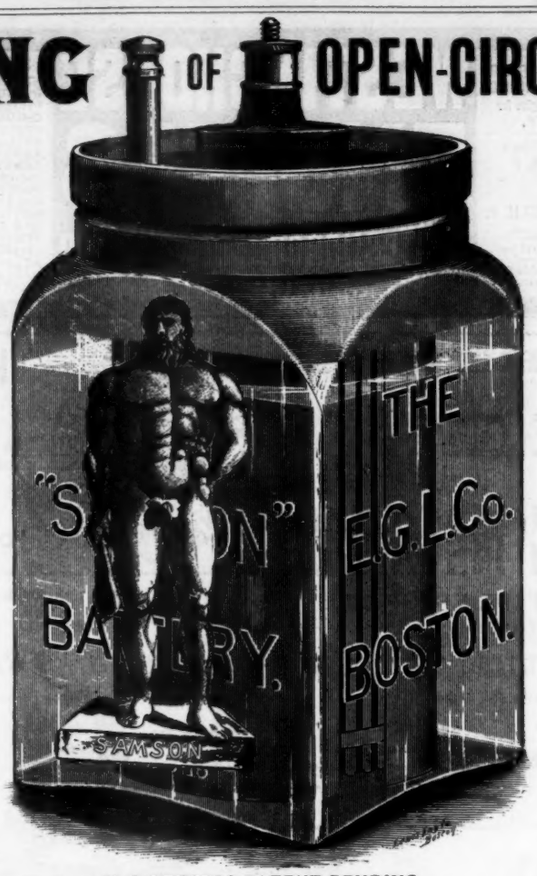

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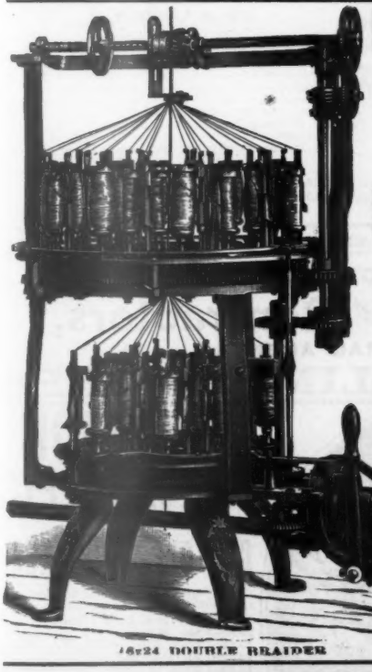

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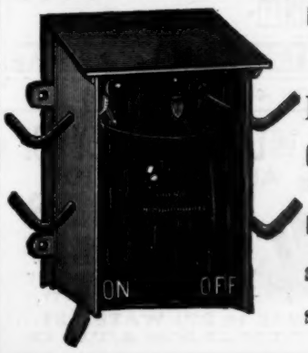

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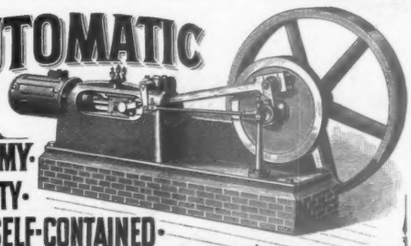

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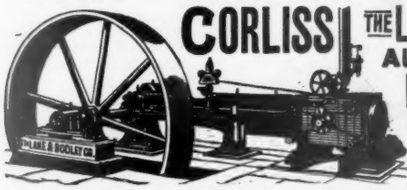

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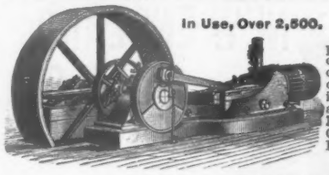

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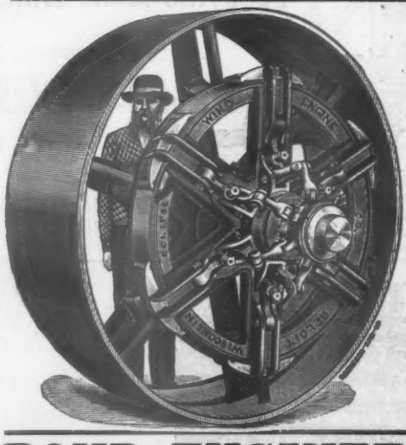

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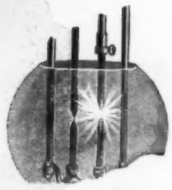

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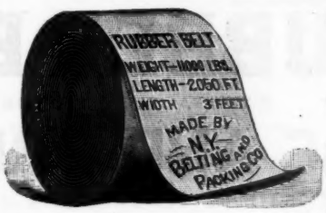

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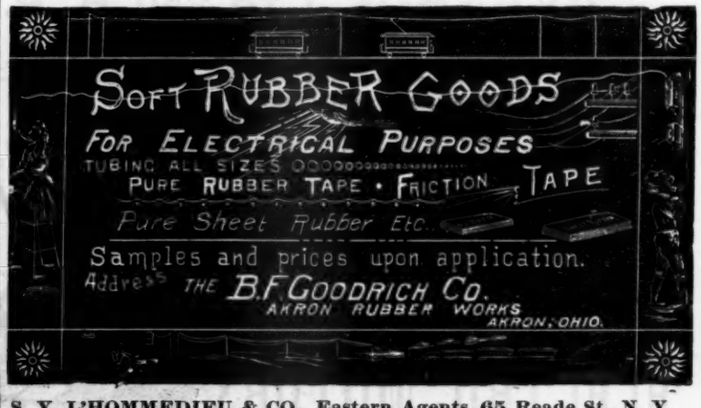

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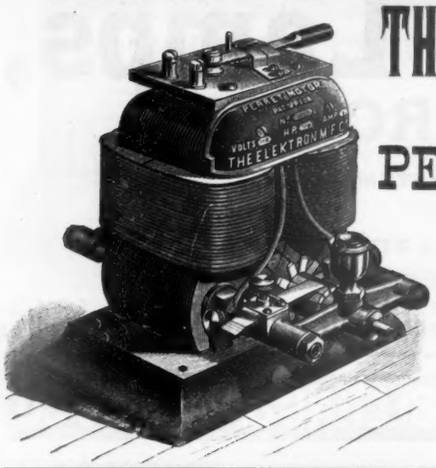

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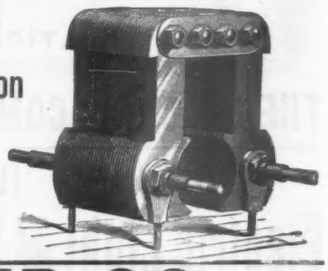

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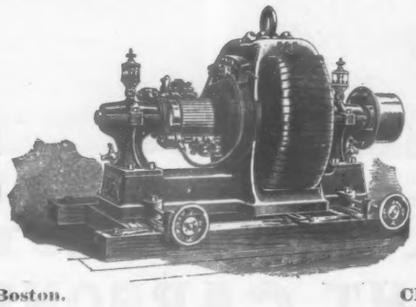

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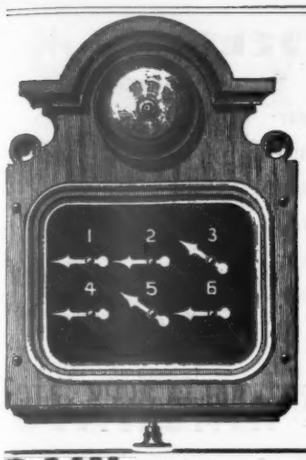

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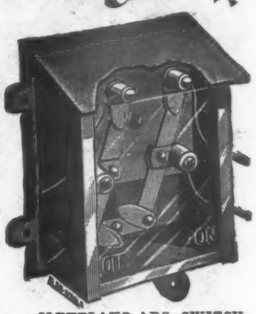

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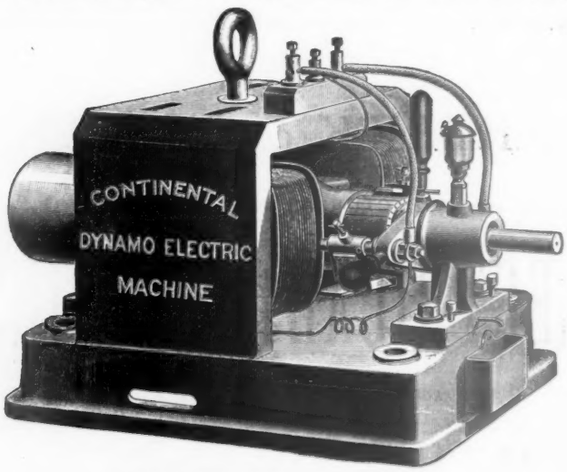

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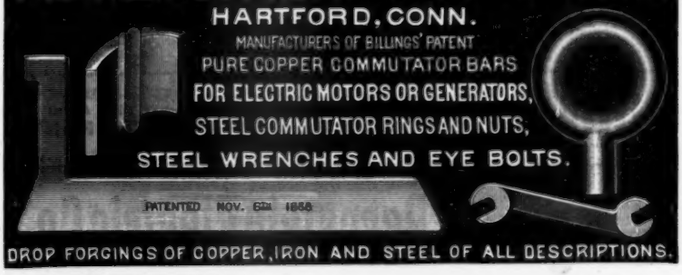

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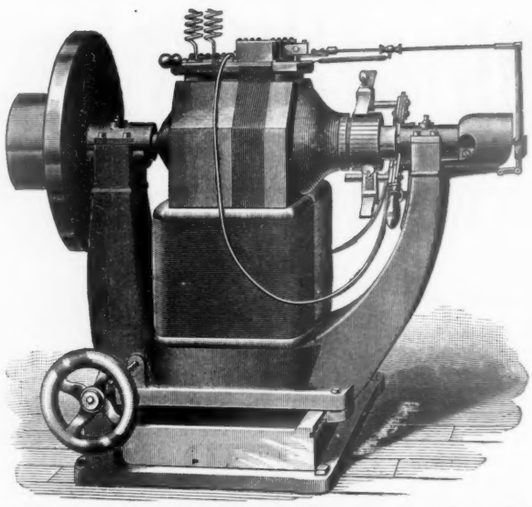

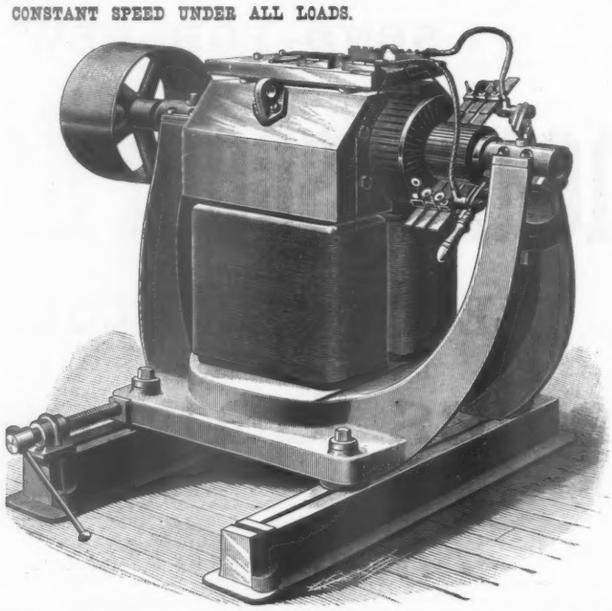

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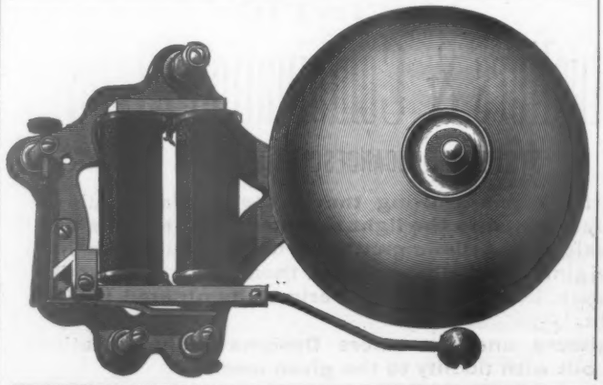

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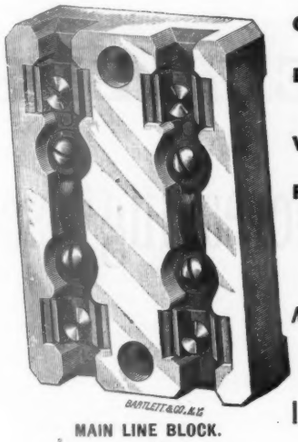

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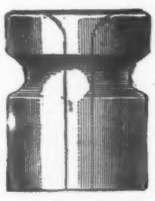

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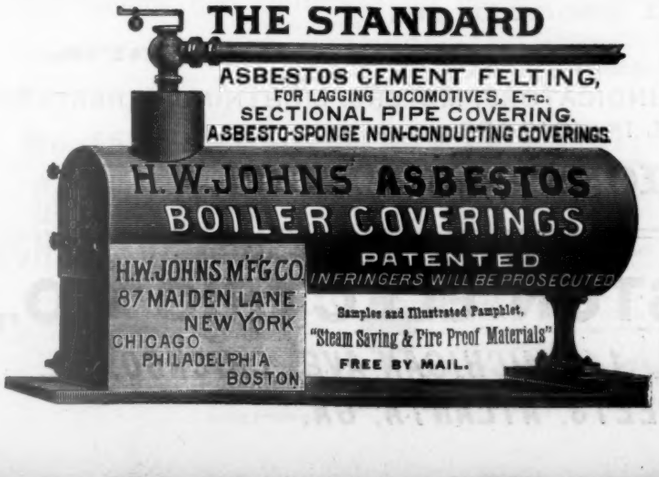

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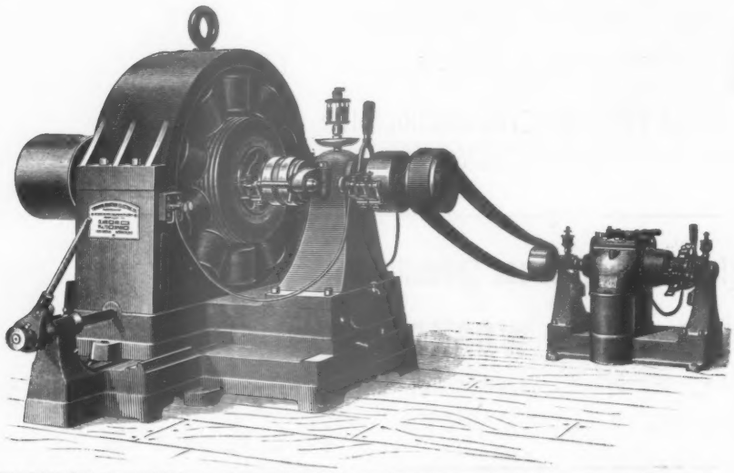

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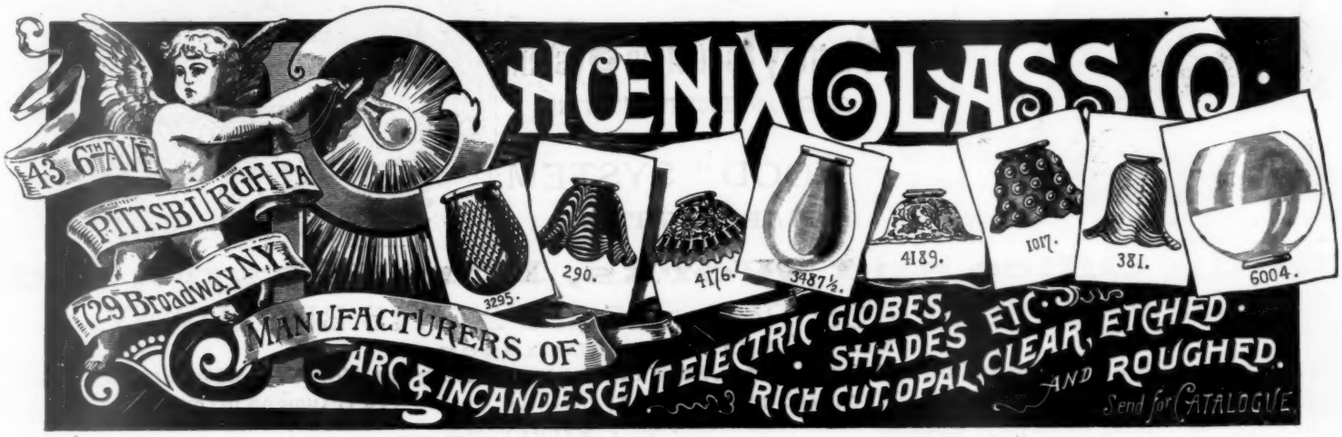

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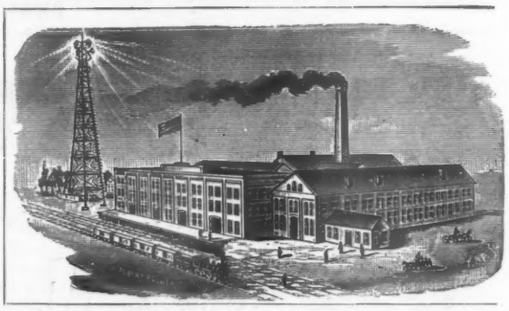

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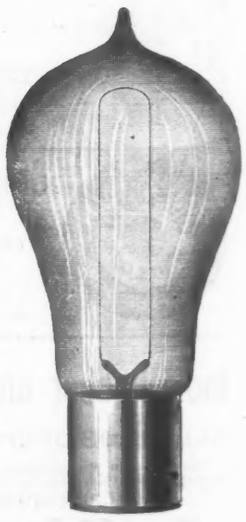

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